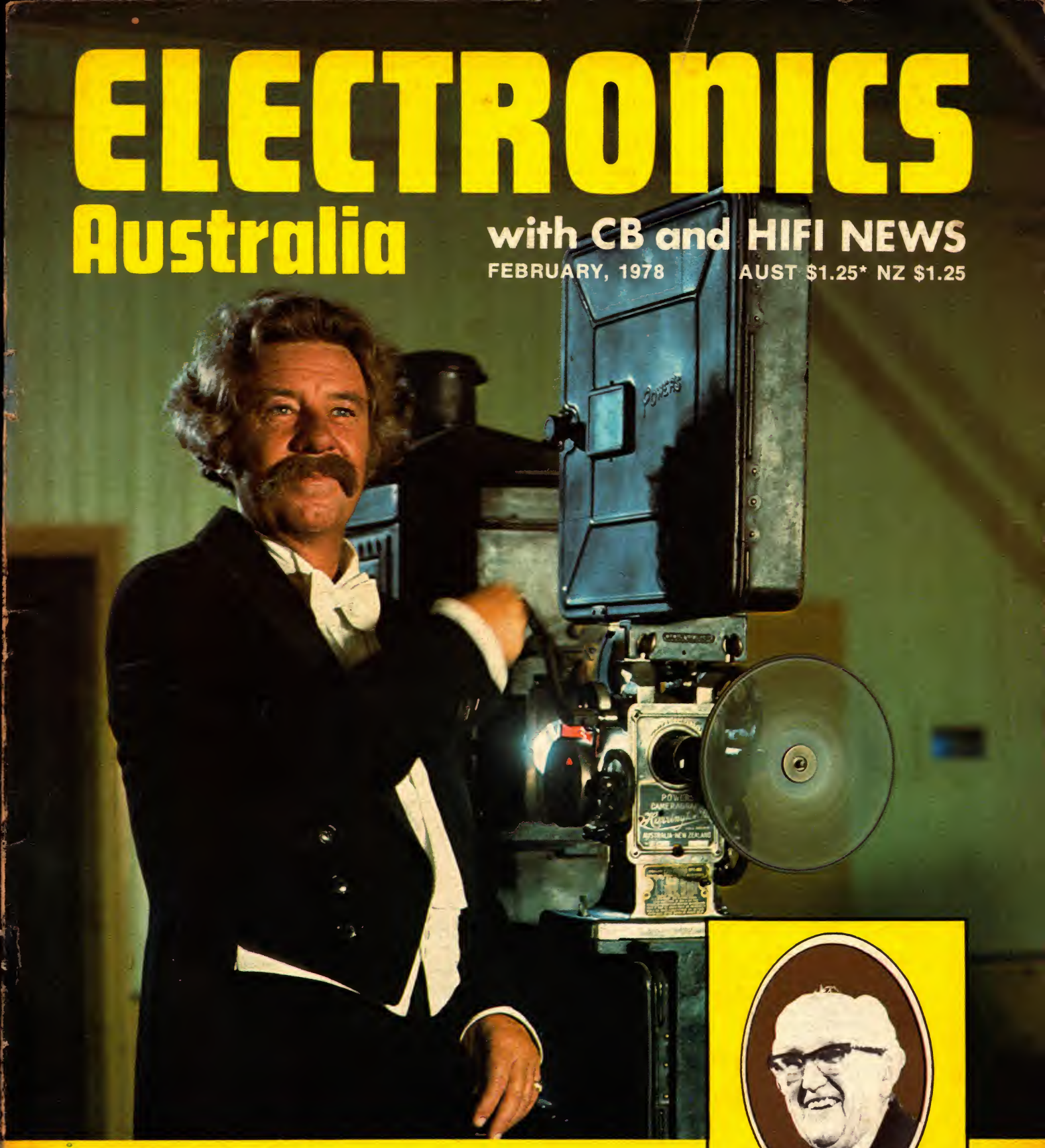
ELECTRONICS Australia

with CB and HIFI NEWS

FEBRUARY, 1978 AUST $1.25* NZ $1.25



LOW COST VIDEO TERMINAL, STEREO CASSETTE DECK PROJECTS

THE MAN WHO PUT THE SOUND INTO CINESOUND

When you're serious...

TC788-4

TC880-2

Sony Reel-to-Reel Decks

If you're through fooling around with Hi-Fi and are ready for some serious sound experiences, get creative with a studio-quality reel-to-reel deck by Sony.

Sony started out first – with Japan's first-ever magnetic tape recorder back in 1950. And in the 28 years since we've maintained our position by applying the results of our massive research into continuing improvements in every aspect of reel-to-reel deck design and manufacture.

That's why when you specify a Sony deck you'll be in great company! Many of the world's best known musicians choose Sony for their personal rigs.

And for good reasons:

Take our state-of-the-art TC880-2 for instance:

- Sony's famous closed-loop dual-capstan drive with Direct Tape Drive gives exceptionally low wow & flutter of 0.02%
- 3 motor – 4 head system including 4 track playback head for accurate and stable tape transport
- Built-in differential amplifier and phase compensator circuit reproduce sound so accurately as to be indistinguishable from source
- Foolproof logic controls with full range of bias and equalisation switches
- Synchro track facility allows sound-on-sound with no time lag for accurate after recording or sound editing.

And if your musical ideas need a studio-quality 4 track record and playback facility go no further than Sony's mighty TC788-4:

- Full versatility with 4 track 4 channel recording and playback, 4 track 2 channel recording and playback, or "Pan-pot" for front to back mixing.
- Synchro track feature for sound-on-sound with no time lag, accurate 'after recording' or sound editing
- All the other features that have made Sony No. 1 in reel-to-reel, such as closed-loop dual-capstan drive, 3 heads for simultaneous monitoring; servo-controlled 3 motor system for accurate tape transport.

These are but two of Sony's full range of reel-to-reel decks. Any one of them will turn your Hi-Fi rig into a truly creative audio instrument.

SONY®

Research makes the difference.

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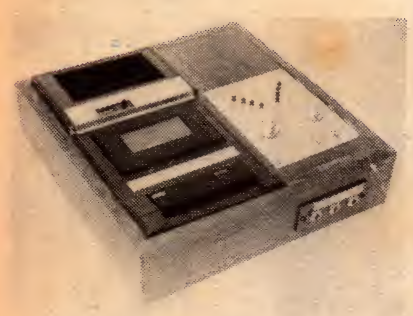
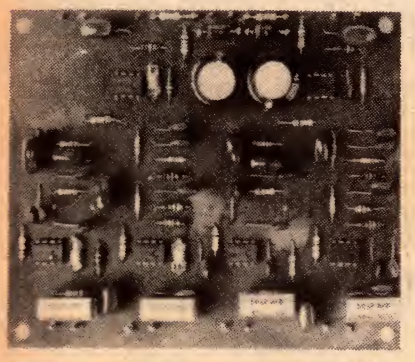
ELECTRONICS Australia

Australia's largest selling electronics & hi-fi magazine
On sale the first Monday of each month

VOL. 39 No. 11 FEBRUARY, 1978



Based on a new top-loading mechanism, our new stereo cassette deck features dual LED monitors for signal indication. Details on p42.



This versatile filter unit has been specially designed for use as an active crossover in hifi stereo systems. Turn to p50.

On the cover

Somehow this shot of well-known Australian actor John Meillon, in the very successful feature "The Picture Show Man", seems to capture some of the atmosphere from our story this month on Cinesound pioneer Arthur Smith. The picture is reproduced by courtesy of Limelight Productions, Producer Joan Long and Roadshow Distributors.

FEATURES

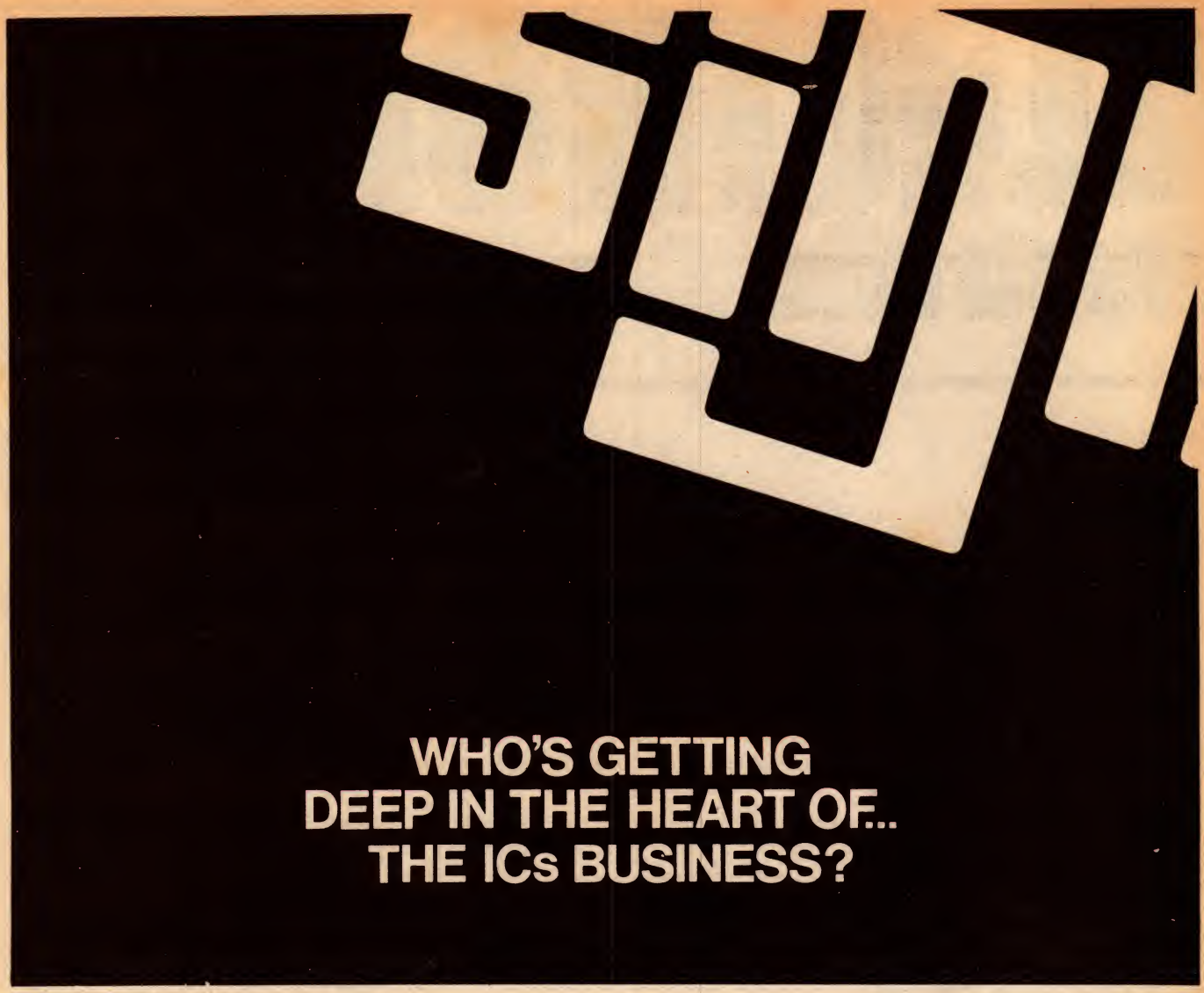
HIFI NEWS & REVIEWS

PROJECTS AND CIRCUITS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS



WHO'S GETTING DEEP IN THE HEART OF... THE ICs BUSINESS?

Until very recently, mention ICs and one or two names came to mind. Certainly there were other firms – but when you needed a really wide range, there was no alternative. Was there? Now there is.

Because Signetics have become part of Philips. That means massive R & D, manufacturing and servicing resources, plus a wider distribution for some of the most advanced ICs ever developed.

The new Signetics has a truly comprehensive range of industrial and consumer ICs to get right to the heart of virtually every application.

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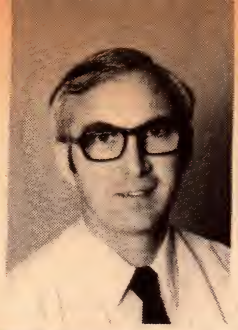

Editorial Viewpoint

A salute to a pioneer

As many of our readers are no doubt aware by now, I have a strong personal interest in old movies and the history of cinematography. If you've been reading the magazine for a while you have probably noticed articles on these topics popping up now and again, when the opportunity arises. I make no apologies for this, because motion pictures and electronics are often quite closely associated, and I believe readers therefore find these articles both relevant and of interest.

Of course I try not to let my own enthusiasm run riot, and unduly influence magazine content. We are, after all, an electronics magazine, and some of our many valued readers might start to lose interest if every second article began to deal with old movie history! Hopefully we're still well away from that point . . .

But as you may have noticed, we have such an article in this month's issue. It deals with Australian sound film pioneer Arthur Smith, and his development around 1930 of the film recorder which was used to make the famous Cinesound talkie features and newsreels.

I was prompted to seek out this story after reading the autobiography of Cinesound director Ken Hall. In the book, the Author devoted about a chapter to the development of the recorder, and it made such interesting reading that I contacted Mr Hall to see if more information might be available. He very graciously suggested that I contact Arthur Smith himself, to get the full story right from the man who had lived it.

Soon after that I spent a couple of enjoyable and interesting afternoons talking to Mr Smith at his home. He was very helpful, and most patient in answering the many and somewhat tedious questions it is necessary to ask in such a situation. He also loaned me the historic pictures we have been able to reproduce in the article, to provide further authenticity.

In writing the story I have tried to record the facts he related to me as accurately as possible, at the same time attempting to capture the human interest side. I hope you find the story an interesting one, and that you join with me in saluting the achievement of Australian movie pioneers Arthur Smith, Ken Hall, Bert and Clive Cross and their contemporaries.

Jamieson Rowe

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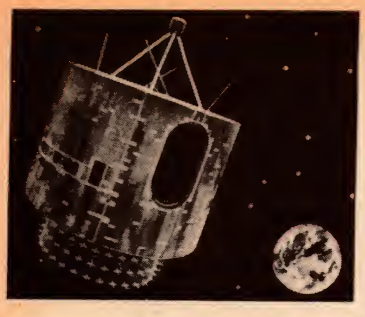


News Highlights

Electronics invades the motor car

Computers . . .

American car buyers are being offered a new option for their cars — a computer!

The dashboard computer, which doubles as an electronic speedometer and fuel gauge, is already available on a limited scale in luxury Cadillacs. But if demand takes off, it is bound to become an optional extra on less prestigious cars.

In addition to showing the car's speed and fuel tank contents, the computer also keeps a check on fuel economy by showing how many kilometres to the gallon the car is getting. Press another button and the computer will tell you how many kilometres the car can travel before more petrol is required. And, by using its memory bank, the computer can tell the driver how far he is from his destination.

However the computer's price — ranging from $500 to $1,000 — is bound to turn off many potential customers, at least for the time being!

Microprocessors . . .

By the mid 1980s, cars could contain from four to eight microcomputers, according to a recent item published in the American magazine "Electronics". Rapid advances in auto electronics, says the item, are being brought about by ever-tightening Federal regulations for emission control and fuel economy.

The design effort to date includes exhaust gas regulation, lean-burn spark advance systems, electronically controlled carburettors, and electronic fuel injection systems. In addition to engine control, other electronic devices will be needed for such functions as diagnostic, multiplexing, radio tuners, automatic brakes and radar crash sensors, vehicle guidance, dashboard displays, alcohol ignition interlocks, and so on.

There will also be a gradual replacement of electromechanical devices by electronic systems. These will include such parts as headlamp controls and windshield-wiper controls. In addition, electronic ignition systems and voltage regulators are now going into second and third generation LSI ICs to achieve more compact units.

. . . and shock absorbers

Monroe Auto Equipment Co, the American shock absorber manufacturer, has come up with a shock absorber with an electronic sensor that can maintain a constant distance between the rear axle and the body of a car or truck as loads are added.

Monroe's sensor replaces the mechanical height leveler installed as an option on some 5% of full-size US cars. It consists simply of two photoresistors, one mounted above the other, on a plastic card that curves around the inside of the shock air-spring chamber. A light emitting diode is mounted at the far end of the card, opposite the photoresistors.

Depending on the load the shock's oil filled tube moves within the air chamber, blocking the LED's light from one, both or neither of the photoresistors. Logic circuitry is used to decode the output from the two photoresistors, turning on an air pump to fill the shocks and raise the body, or a solenoid valve to bleed the shocks, as appropriate.

A simple RC time delay circuit is used to blind the system to normal suspension movements encountered in everyday driving.

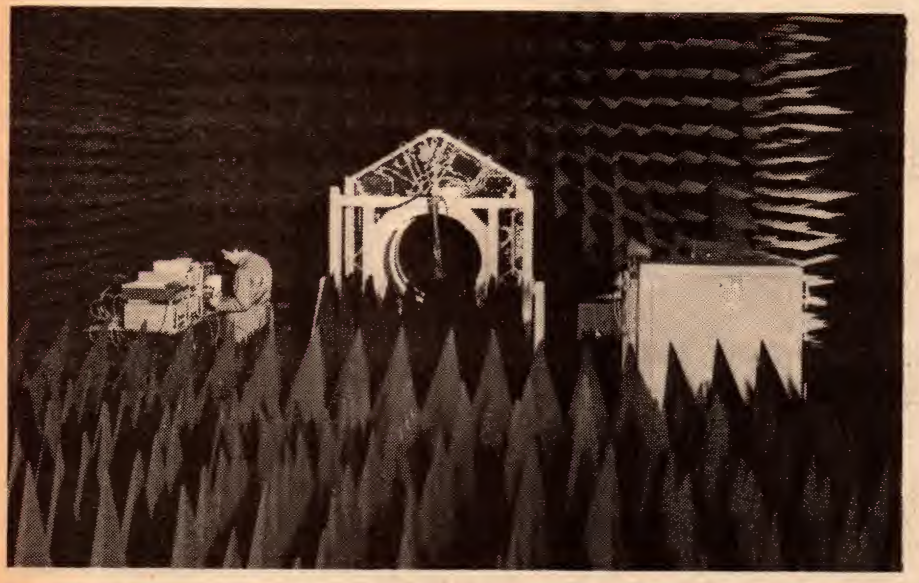
Ford Motor Company and Chrysler Corporation are both reported to be testing the system, while General Motors Corporation will offer a similar electronic system in its 1978-model cars.

Cockpit lighting for patrol plane

Brigadier General Alan Pickering, head of the Canadian project team at Lockheed-California Company's Burbank plant, sits in the mock-up of the CP-140 aircraft the company is building for the Canadian Forces. He is inspecting the new cockpit lighting system developed for the long-range patrol plane.

NEWS HIGHLIGHTS

All quiet at Hawker Siddeley



A £¾m anechoic chamber, claimed to have the world's largest quiet zones, has been installed at Hawker Siddeley Dynamics in southern England. It is part of the company's complex designed specially to handle the assembly and testing of satellites.

Containing some 14 tonnes of profiled pyramids made from microwave absorbent materials, the chamber measures 18.3 x 7.3 x 7.3m and will be used in the study of radio frequencies, electromagnetic compatability and radio frequency interference. It is being used to test the MAROTS marine communications satellite which will be stationed in space this year to cover the eastern Atlantic, Indian Ocean and South China Sea. Hawker Siddeley Dynamics is the UK prime contractor for this project.

The chamber will not only be used to test satellites but will provide measurements on radar and missiles and to assess microwave components such as antennae.

Telecom criticised for equipment cutbacks

The Chairman of the Australian Telecommunications Development Association, Mr A. T. Deegan, has said in his annual report that the association is gravely concerned that if Telecom Australia continue to restrict their capital expenditure below a reasonable level, they run the risk of network deterioration beyond that necessary to cope with existing customer requirements and future expansion.

Mr Deegan's report is contained in the ATDA's annual publication "Telecommunications 1977".

He says in his report: "The steady decline in the telecommunications manufacturing industry evident in the past three years has unfortunately continued this year. At the present time it is difficult to see any promising signs for the industry."

Mr Deegan said that a survey carried out earlier this year had highlighted the steady decline in the industry since 1972.

In that year the industry employed just over 21,000 people, but in the past five years just over half this number had lost their jobs, many of them key engineers and technicians.

Business Briefs:

- New to Blacktown, NSW, is C.Q. Electronics, stockists of electronic kits, components, and CB radio equipment. The new store is located at Shops 9 & 10, Town Centre, 30 Campbell St, Blacktown 2140 (Telephone 621 5809). Proprietors are George and Charles Berzin.
- Sydney-based components distributor, Amtron Tyree, has established a sales office in Adelaide at 4 Morrison Court, 8 Unley Rd, Unley, SA 5061 (telephone 71 7691). South Australian manager is Mr Ray Gudgeon.

Computer based information service

Established to improve Australian access to the world's scientific and technological literature, the Australian National Scientific and Technological Library (ANSTEL) has developed a wide range of services based on computerised data retrieval systems over the past few years. ANSTEL is a branch of the National Library of Australia.

One of the services offered by ANSTEL is the Science Citation Index Service (SCI) . This is a multidisciplinary database produced weekly by the Institute for Scientific Information, USA, in the form of magnetic tapes . These tapes contain details of articles from nearly 4,000 of the world's most significant scientific journals.

Included in the tapes are the following broad subject areas: agricultural, biological and environmental sciences; engineering, technology and applied sciences; physical and chemical sciences; medical and life sciences; and the behavioural sciences.

What can an SCI search retrieve? Subject to individual requirements, the following are possible:

- all works with titles containing specific key words or combinations of key words;
- all papers citing a particular reference;
- all papers citing works published by a particular author;
- all works by scientists associated with a particular organisation; and
- all works published by a particular scientist.

Retrospective literature searches are also possible under the SCI system. For further information, contact the Chief Librarian, SCI Service, ANSTEL, PO Box E333, Canberra 2600.

New concrete conducts electricity

A revolutionary new building aggregate for producing electrically conductive concrete has been developed by researchers at Marconi Communication Systems Ltd, England.

Called Marconite, the new aggregate produces concretes of normal compression strengths but with a wide range of pre-determined resistivity values. According to Marconi, this offers the possibility of permanent earthing, screening for electrical and electronic equipment, and protection from the hazards of static electrical discharge.

The use of Marconite to provide an earth plane in the form of a floor screed would provide a simple, universal earthing and screening system which could be extended as work progressed, the company claimed.

Applying for a patent

For most would-be inventors, applying for a patent is a confusing and — seemingly — expensive business. This article shows just how easy it is to make your own patent application, and looks at the requirements and the costs.

by M. G. MAXWELL

There must be few engineers or technicians who have not thought up some idea from which they hoped to be able to make some money, but who have not proceeded with it because to do so might have necessitated taking out a patent — a course upon which they have hesitated to embark because they thought the process would be too involved and too costly!

Thus, many ideas which might have been of benefit to society, and to the inventor himself, may be laying fallow in the form of rough sketches and notes simply because the inventor does not know how easy it is to make an application for a patent.

We all know that you can give your invention information to a patent attorney who will look after the whole business of the patent for you. But with these gentlemen, as with other members of the legal profession, you start paying out dollars almost as soon as you enter their doors.

It is for those ordinary individuals with limited finances that this article has been written. The patent process is complicated, but, to those accustomed to engineering discipline, simple to follow provided you go the right way about it.

First, the cost if a patent attorney handles the matter. Undoubtedly, you will be up for several hundred dollars just to make application for an Australian patent. Foreign patents will cost much more because it may be necessary to employ an attorney in the country in which you desire to apply for a patent, this in addition to your own attorney in Australia.

A typical quotation from an attorney in Sydney for the author to apply for a patent in the United States in May 1977 was between $700 and $1000. This was for a simple, straightforward patent which already had been patented in Australia, and for which the specification was, in consequence, already prepared.

In making your own application for a patent, the very first step is to ensure that you have clearance from your company to go ahead. Many firms require their technical staff to enter into an agreement whereby any patent which relates to the business of the company remains the property of the company. Even though your name may appear on the patent documentation as the inventor you will be unable legally to enter into any negotiation in connection with the patent. So check this point first.

Next, it goes without saying, that your idea must be original — and it must be useful. These are not the only requirements, but they are the two you must consider before applying for a patent.

Whether or not your idea is likely to be useful, only you can decide. Assuming that it will have some use, your next step is to find out if it is new. But first, a word of warning to be borne in mind throughout the whole business — do not discuss the idea with anyone, unless of course you have a partner who has worked on the idea with you, in which case you should pass the warning on to him!

The term "new" in this context means that the idea must not have been revealed to the public by any means, such as by publication in a journal or newspaper, or by manufacture and sale of the item you wish to have patented. Moreover, a patent can be revoked if the invention has been secretly used commercially by the patent applicant prior to his applying for a patent.

So the less discussion the better. If people get to talk about your idea it might be held that the invention had been disclosed, so rendering the application for a patent invalid.

Now, how does one find out if the invention is new?

As a practising engineer or technician you will necessarily have had to read the various technical journals associated with your line of business, so you should have a pretty fair idea if it is new or not. Naturally, you wouldn't be going ahead with the idea if you had read about it somewhere, but it is a good idea to read up as much as you can on the subject before you get too involved.

Assuming that the "state of the art" is such that your invention appears to be new, the next step is to find out if such an idea has been patented in Australia by anyone else.

CARRYING OUT YOUR OWN SEARCH: To do this you need to visit the Trade Marks Sub-office in the capital city of your state. In Sydney, this is located on the 6th floor of 189 Kent Street, at the harbour bridge end of the street. The hours are from 10am until 4pm.

Incidentally, if you are looking up the telephone number of these offices, look under "Trade Marks" not under "Patents". Allow yourself at least a full

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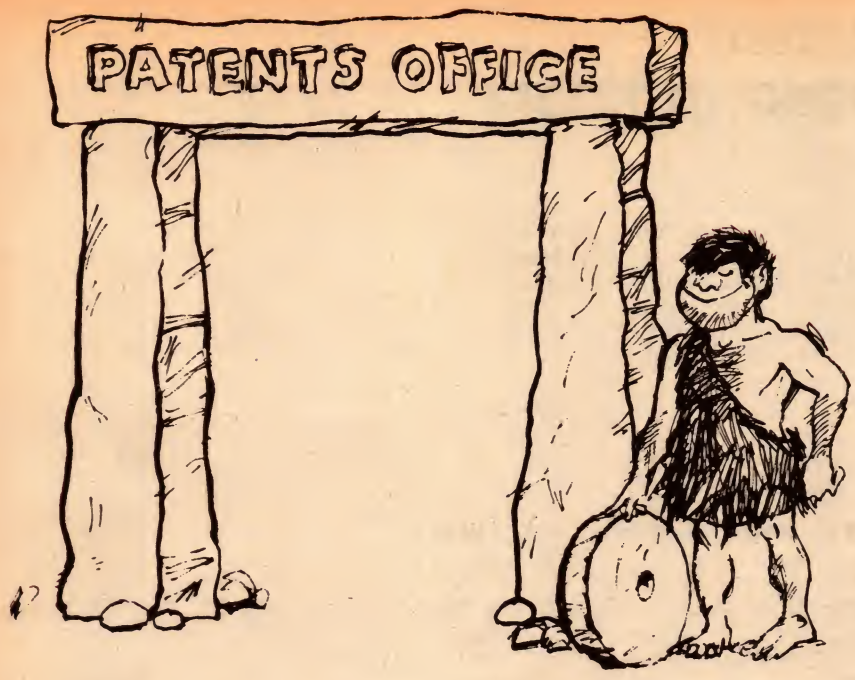


day to visit the office as it can easily take this long to go through all the patent specifications you will need to examine. Take pen and paper as you may need to make notes.

Inside the office you should find a file index, which you can go through yourself to find out which files you need. Remember that previous patents of the invention (which you hope you will not find) may be listed under more than one heading. For example, "Fire Alarm" may be listed under "Alarm" or "Fire" or "Protection", so you need to be pretty careful — you may spend the better part of the day going through files under one heading, not knowing that your invention may have been patented and listed under another.

With the file numbers listed, you can then try to find the files for yourself or, better still, ask one of the assistants to set you right — you will find that they are most helpful.

On your way out, assuming that you have not been able to discover a previous patent of your invention, collect the following documents: one copy of "Guide for Applicants for Patents", cost $1 (in a pocket in the back cover of this booklet there should be specimens of patent specifications — make sure that they are there); one copy of Letter Form A, — this lists the scale of fees and is free; one copy of Letter Form AX, — this gives the formal requirements, that is, size of drawings, specifications etc. This is also free.

You should also collect four copies of each of the following: Form 1 — Application; Form 7 — Declaration; Form 9 — Provisional Specification; Form 9A — True Copy Specification; Form 10 — Complete Specification; and Form 10A — True Copy Specification.

These forms are all issued free of charge.

You don't really need four copies of each of these forms — only one of each is required to make the actual patent application. The extras are in case you spoil some copies, and for subsequent patent work. Check with an assistant that no other documents are necessary. The "Guide for Applicants for Patents" booklet is an absolute must — you cannot make out your application properly without it.

THE COST: You are now about to embark on the actual patent application itself. You do not require a fat cheque book. The cost of applying for a provisional patent in Australia is currently five dollars.

PREPARING THE APPLICATION: From now on, all the information you will need will be found in the guide and forms listed above. There are a lot of detailed requirements in Letter Form AX which demand fairly meticulous attention, such as width of margins, size of letters etc. to be used in the specification.

You will need to draft the specification in rough form first because the specification you submit must not contain any alterations or erasures. The final document needs to be double spaced typed on good quality foolscap size (A4) paper using one side of the paper only.

Typically, the cost of having the specification typed runs out at about $8 per hour and a quotation from a typing firm for a 10 page specification was $16 at the time this article was being written.

Whatever you do, make sure that you keep at least one copy of the specification. Other copies may be needed later on, particularly if you want to show the invention to a potential manufacturer. These copies are best run off on a photostat machine, as this will give a better (and more businesslike) result than carbon copies.

At this point, you will be faced with another decision concerning your patent application — whether to submit a provisional specification or a complete specification. We shall examine each of these alternatives in turn.

PROVISIONAL SPECIFICATION: This is probably the most common form of patent application because it gives the applicant a year in which to modify or add to his invention. Each modification or addition must be lodged in the form of additional provisional applications so if you make three such alterations, for example, you will be up for another $15.

Before that year expires you must lodge your complete specification, otherwise the original provisional patent application will lapse. If it does so lapse, you can still carry on but you have to start all over again and you will have lost your priority date.

The priority date is established when the provisional application is recorded by the Patent Office in Canberra. You will be informed of this within about two weeks of lodging your application.

The priority date does not mean that you can sue for infringement of the patent as from that date — this is explained more fully in the guide. The priority date is important in the event that someone else lodges an application for the invention and a dispute arises as to who was the first recognised inventor.

If you do not need more time to work on the invention, and it is sufficiently advanced for you to be able to write a complete specification, then it is better to lodge a complete specification from the start. This will give you earlier protection than a provisional application.

COMPLETE SPECIFICATION: While the description of an invention in a provisional application need only be in general terms, a complete specification must fully describe the invention, with details as to how it is to be made. This will generally require drawings.

A most important part of a complete specification is the section stating the claims which define the scope of the protection sought by the applicant. The claims section demands most careful thought, as the applicant is only protected for what he claims. The claims should be stated in the broadest possible terms so as to exclude anyone else from using any part of the invention. The specimen specifications in the back of the guide should be most helpful here.

Applying for a patent — the things you need to know

The fee for lodging a complete specification is $25 if a provisional application has already been made, plus $2 per sheet in excess of 10.

DISCLOSURE: On lodgement of the application — whether it is for a provisional or for a complete specification — you will receive from the Patents Commissioner's office a receipt for the application fee on which will be recorded the date of lodgement of the application. Once this date has been established, you may publicly disclose the invention without endangering the validity of the patent.

This means that you are free to discuss it with prospective manufacturers without jeopardising the protection afforded by the patent application.

PROTECTION: Protection normally starts 18 months after lodgement of the complete specification. However, protection may be secured earlier than this by making written application to have the damage point moved back, in which case protection starts three months after lodgement of the complete specification.

Thus, if you want the very earliest possible protection for your invention, you should dispense with the provisional application and, instead, lodge a complete specification straight away, together with a written request to have the invention made available for public inspection within three months.

There is an additional fee to be paid if you request that the damage point be moved back. This is quite small however, and the author had recently to pay only an extra four dollars for this to be done.

INFRINGEMENT: Legal proceedings for infringement of a patent cannot be commenced until the patent has been granted (sealed). This could take three or four years after the original application was made. Moreover, damages will only be awarded back to the date on which the complete specification became open to public inspection, which means that you are not covered for damages during the period of a provisional application.

SUMMARISING SO FAR: Having digested the foregoing, and with the help of the patents guide, you should now be in a position to decide what to do. To get started, your outlay need only be six dollars — five dollars for the provisional application fee plus a dollar for the guide.

If you cannot get the specification typed for nothing, then you will need another 15 or 16 dollars for typing, say 10 pages, plus about three dollars for one photostat copy — say 25 dollars in all. You now have one year to decide whether to carry on or not.

Don't overlook the fact that you have a fair amount of protection inbuilt in the commercial process itself once you have made your patent application. Most inventions need the expenditure of a considerable sum of money in tooling and so on if they are to be manufactured in quantity. No would-be infringer is likely to invest that kind of money in a project if he knows that he may subsequently be sued for damages.

So there is really no need to worry too much about infringement of your patent — at least in the early stages.

Your main risk is that your specifications may leave loopholes for unscrupulous individuals to exploit your invention without risk of litigation. Make sure that the patent application is written in such a manner as to take into account every possible use of the device.

SELLING YOUR IDEA: Now comes the hard part — you have to convince someone to put up the money to get your invention manufactured. Deal only with reputable companies. They not only know about patents but have their reputation to consider and are not likely to steal your idea and have it made and marketed overseas where you have no protection.

Remember, though, that once a company has a copy of your specification there is nothing to stop them making copies for their overseas associates. They cannot market the device in Australia as you have applied for the patent, but it can be made and sold overseas without hindrance.

It is better to deal with an established firm already operating in a field similar to your invention. They will not only have the necessary manufacturing capability, but marketing facilities as well.

The kind of deal you enter into is up to you, but by far the simplest in all probability is to try to sell the patent rights outright or, failing that, arrange to have the device made under licence so that you can collect royalties. If you opt for royalties, don't settle for so many dollars or cents per item manufactured. Settle only for a percentage of the retail cost of the item for this takes care of inflation — a dollar per item now will not be worth the same amount to you in, say, five years' time whereas a percentage keeps pace with market escalation.

Before you sign any agreement or contract, it is a wise precaution to have an accountant or solicitor look over the document to make sure that your interests are properly provided for. You are now entering the hard world of business where the only unit of measurement is the dollar and where, historically, the inventor has often come off second best.

To properly present your invention to potential manufacturers, you simply must have a well-made prototype — not your experimental version, which may work very well but probably looks as though you have had problems with it. Something like the final version to be presented in the market place is required.

Technical specifications and drawings may be understood by the technical staff of your prospective manufacturer, but you have to convince the man who is going to sign your royalty cheques, and he most likely will not be a technologist.

OVERSEAS PATENTS: Most inventions, if they are to be commercially viable, must be produced in large quantities so as to offset the costs of tooling and other initial factory costs in as short a

This late model stereo cassette deck from Sony incorporates one of the classic patents of electronics — the Dolby B noise reduction system. All decks incorporating this system are manufactured under licence to inventor Ray Dolby, an American engineer residing in London. There is always room for the individualist in technological invention, says Dolby.

time as possible. Such volume production requires a volume market and it may well be that such a market for your device does not exist in Australia because of its relatively small population. In such case you may decide, after you have had negative response from local manufacturers, to venture further afield by seeking patent protection overseas.

Your first problem is to find out if your invention has been patented abroad. The only place in Australia where you can properly make your enquiries is at the Patents Office in Canberra. The Trade Marks offices in other capital cities list only those patents which have been granted in Australia, so you will either have to go to Canberra to make your search or have someone else do it for you. The Patents Office is not empowered to carry out the search for you.

You don't have to make a search before applying for a patent, but if you do not you can waste a lot of time and a fair sum of money if you go ahead and then find later on that someone has beaten you to it.

To apply for a patent in the United States, the best way to start is to write to the Commissioner of Patents and Trademarks, Washington, DC 20231 and ask for a copy of each of two booklets — "General Information concerning Patents" and "Questions and Answers about Patents" — they are both issued free of charge.

The general information booklet tells you how to go about applying for a patent in the United States — you will not need any special forms as you do when applying for an Australian patent.

There is no provision for provisional patents in the United States — you simply apply for a patent. The cost is not exorbitant. The basic filing fee is 65 dollars plus 10 dollars for each independent claim in excess of one, with an additional two dollars per claim which is in excess of 10. The fee for issuing the patent is 100 dollars plus 10 dollars per page of specification and two dollars for each sheet of drawing.

Thus, if your application contains five pages of specification, five drawings and five claims the cost of the patent issue will be $US255. (These figures were valid as at June 1976.)

You do not need to operate through a patent attorney or solicitor to apply for a US patent — you can deal directly with the Patents Office there as you can in Australia.

Each country has its own patent laws so it is best to find out about these first before going ahead. You can do this by contacting the appropriate trade commissioner in Australia who should be able to give you the address of his patents office. In South Africa for example, a patent application may only be made through a registered patent attorney or lawyer based in that country. Other countries may have the same requirement and it is essential to find out such things, together with likely costs, before you get too involved.

Just one final word of warning — the cleverest idea is not worth patenting if the end product is not something that the community needs because if it is not needed it will not sell. Your idea must not only be original — it must also be commercially viable.

The man who put the

In 1930, motion pictures had just entered the talkie era, and the big Hollywood producers had invested very large sums in developing sound recording equipment. Yet shortly afterward a retiring young Australian radio engineer named Arthur Smith, working under primitive conditions and with almost no money, was also able to produce a fully practical sound recorder. His achievement made possible the famous and highly successful Cinesound feature films, as well as the Cinesound Review newsreels.

by JAMIESON ROWE

Although the name Cinesound may not mean a great deal to many of our readers nowadays, it was very well known in Australia during the period from 1931 to about 1958. During the thirties, Cinesound was the most prolific of the then-flourishing Australian feature film producers. Under the direction of Ken G. Hall it produced a string of highly successful features, which competed strongly against films from America and England.

So popular were Ken Hall's Cinesound features that they have long since become a part of Australia's cultural heritage, remembered fondly by anyone lucky enough to have seen them. Titles like "On Our Selection", "The Squatter's Daughter", "The Silence of Dean Maitland", "Thoroughbred", "Orphan of the Wilderness", "Tall Timbers", "Dad and Dave Come to Town", "It Isn't Done", "Gone to the Dogs" and "Mr Chedworth Steps Out" are still capable of entertaining modern audiences, and did so when they were shown on ABC television a couple of years ago.

At the same time as they began producing feature films, Cinesound also started a weekly cinema newsreel, the Cinesound Review. Like the feature films, this quickly became popular, and for many years was an established part of Australian cinema programs. Many issues of the Review were narrated by Charles Lawrence, the famous radio personality. It also notched up many "scoops", including a world exclusive of Captain de Groot upstaging NSW Premier Jack Lang at the opening of the Sydney Harbour Bridge in 1933.

Most of the Cinesound feature films and many of the Cinesound Review issues are stored for posterity in the National Library's archive, in Canberra. They form a major part of the collection of Australia's film productions during the 1930's and 1940's.

Cinesound features and newsreels weren't just popular with cinema patrons, either. Cinema projectionists and managers came to regard them as standards of technical excellence. The sound tracks in particular were regarded by the standards of the day as excellent, with high output and low distortion. So much so that repair technicians often used a reel of Cinesound film when testing equipment, knowing that it was capable of good results.

Even when judged by modern standards, the sound quality on the early Cinesound features and newsreels seems surprisingly good. Distortion is

sound into 'Cinesound'

low and signal level is high, giving a good signal/noise ratio. The frequency response is smooth, and although not wide is entirely adequate.

Yet none of the Cinesound films were made using the sort of elaborate and expensive equipment used by the big overseas film producers. The pictures were taken using elderly cameras, most of them inherited from Cinesound's predecessor, Australasian Films, and dating from the silent days. Even more surprisingly the sound recording equipment was all designed and built locally, by a young Australian radio engineer named Arthur Carrington Smith.

In a very real sense, Arthur Smith was the man who made Cinesound productions possible, by developing a fully practical sound recording facility locally and at low cost. Literally, he put the "sound" into Cinesound. And there is a fascinating story behind this achievement, one which I believe readers will find very interesting. But let's start at the beginning....

Arthur Smith was born in Launceston, Tasmania in 1902. After leaving school he went to Melbourne and studied radio operating and engineering at the Marconi School of Wireless. He found that he didn't much like radio operating and, in about 1922, returned to Launceston and joined a radio dealer who was setting up a local radio station. The transmitter the dealer had acquired was very crude, but Arthur Smith modified and improved it, and the station was technically very successful. However the company formed to run the station ran into difficulties and folded in mid-1926.

Out of a job through no fault of his own, Arthur Smith started his own business designing and making battery radio receivers. This was fairly successful, but in 1929 he became interested in the future of sound motion pictures, as a result of discussions with the Launceston manager of Paramount Pictures.

He heard that there was a job going with Western Electric, servicing their sound equipment installed in the Tasmanian cinemas but, when he journeyed up to Sydney to apply for the job at the Western Electric office, he found that someone from Hobart had landed it a week earlier! So he found himself looking around for other possibilities.

As it happened, he knew Ross Hull, then the Technical Editor of "Wireless Weekly", which was the main predecessor of "Electronics Australia". By chance he visited Hull, who said that he thought that there would be more future in the recording and production side of sound motion pictures than in the servicing of theatre sound systems. He also told him that Australasian Films were trying to develop a practical sound film recorder, out at their laboratories in Bondi Junction.

The picture at the top of the facing page shows Clive Cross (leaning on microphone), Wally Sully (holding camera) and Arthur Smith (wearing headphones) while testing the first production sound recorder on location at Holsworthy army camp, in late 1930. The picture above shows the production team on location at Castlereagh in 1931, while shooting their first feature "On Our Selection". Arthur Smith is seated, cigarette in hand, just in front of the trestle supporting the camera motor. Note the improvised microphone boom.

The man who put the sound into 'Cinesound' . . .

So Arthur Smith paid a visit to the Bondi Junction laboratory, which was mainly used at that time for making local release prints from imported negatives. It was at the rear of a big silent-film production studio, then being leased as a skating rink. He introduced himself to the manager, Bert Cross, who told him that he was keen to get a sound film recorder designed and built. There was just one small catch: he had no money to pay for it, as the company's top management had no idea of what he was trying to do!

It turned out that some attempts had already been made to produce a recorder, by Don Knock — who had been joint Technical Editor of "Wireless Weekly", with Ray Allsop, before Ross Hull. But the results Knock had obtained had been disappointing. When Arthur Smith saw the equipment, he believed he could see a number of ways in which it could be improved. So he told Bert Cross that he would lend them a hand, at least until he found something else.

He began working on the project, and quickly became engrossed in the problems to be solved. Which was just as well, for shortly afterwards Don Knock was forced to pull out. They were not being paid, and his savings were exhausted. So Arthur Smith worked on, with welcome assistance from both Bert Cross and a precision mechanical engineer named Bert Wickens.

Don Knock had been trying the glow-tube approach, first pioneered by Eugene Lauste around 1906. The idea was to feed the amplified sound signals to a discharge tube, to produce an amplitude modulated light beam capable of being recorded on the film. Knock had obtained a tungsten-arc discharge tube with spherical electrodes and, although it worked in a fashion, the recordings were woeful — very weak, and with gross distortion.

After a series of tests Arthur Smith decided that the method used by Knock to drive the discharge tube was inappropriate, because of the arc's negative resistance characteristic. So he changed over to a circuit giving substantially constant-current drive, at the same time improving the power supply arrangements. The changes gave considerably lower distortion, and encouraged him to work on other improvements.

Progress was not easy, due to the lack of facilities. He had virtually no test equipment apart from basic voltage and current meters. Of course very few of the instruments one would nowadays regard as essential for that sort of work had even been invented in 1929; even if they had, he would not have had the money to buy them!

There wasn't even a sound film reproducer at Bondi Junction. Whenever he wanted to hear what a test film sounded like, he had to make the trip into Australasian Films' preview theatrette in Pitt Street, Sydney, and ask the projectionist to run it for him!

It was also necessary to make regular visits to the Mitchell Library, both to study the work of some of the earlier researchers and to keep up with the overseas technical literature.

Despite the privations, he made steady progress. By about the middle of 1930 he was making recordings of consistently low distortion, although he still wasn't happy with the high frequency response. He seemed to be up against a fundamental limitation of the tungsten-arc tube, as the ball electrodes seemed to retain too much luminance.

But although Arthur Smith himself was still not satisfied, Bert Cross was impressed. It seemed to him that the results were now good enough for commercial exploitation, and he rang Ken Hall who was at that time assistant to Stuart F. Doyle, head of Australasian Films and Union Theatres. That afternoon Ken Hall found himself meeting Arthur Smith and hearing the story. Then they went around to the preview theatrette in Pitt Street, where Hall listened to the latest of the test films.

It was a short piece they had made a few days earlier of two organists, Henkel and Scholes, who had just returned from New Zealand. Part of the film was silent footage of the two arriving at the wharf, to which they had added sound effects; the remainder was some dialogue recorded at Bondi Junction.

As Ken Hall writes in his autobiography, it did not seem possible that a single Australian, with little money behind him, could have designed and built sound recording equipment that worked — when everybody was aware that the American giants Western Electric and RCA had spent, and were continuing to spend, millions on the development of the recorders and reproducers they were selling worldwide. Yet the sound seemed good, and Ken Hall's reaction was like that of Bert Cross — they had something very promising.

Ken Hall had a hard time convincing his boss Stuart Doyle, but finally Doyle agreed to back the project. He signed a contract with Arthur Smith, undertaking to pay him £800 to produce an improved recorder and production sound system. Although the money was to be paid in monthly instalments, it was timely because Smith's savings were down to the last few pounds.

A condenser microphone was also ordered from America. The only microphones Arthur Smith had available for his testing were carbon types, and it was evident to him that they would need something better if they were going into production of talkies.

Not long after he had started on the construction of the new recorder, he heard that BGE-Osram had released an new glow-discharge recording tube. He obtained a sample, together with design data, and tried it out. The results were so much better than with the tungsten-arc tube that he immediately changed the recorder design to incorporate the new tube.

The BGE-Osram tube was quite different from the Case-Sponable "Aeolight" tube used in the American Fox-Movietone system. It contained a mixture of neon gas and mercury vapour, with some free mercury also present in the tube. The neon was used to start the discharge, with the mercury taking over after warm-up. It gave high light output, yet could be modulated well, even at high frequencies.

After studying the makers literature, Arthur Smith decided to drive the tube with constant current, by connecting it

One of Arthur Smith's more recent sound recorder designs: a fully transistorised portable magnetic recorder using 17.5mm film, produced in 1961.

into the plate circuit of a pentode output valve running from a 700V battery supply. Tube current was set at the recommended 15 milliamps. But instead of using the optical system suggested by the manufacturers, to direct the tube output onto the film, he used an improved type of optical system suggested in a paper he had read.

The new recorder worked really well, and the recordings it made were much better than those of the first experimental model. To try it out they filmed and recorded a well-known radio announcer introducing the next big picture to be previewed at the State theatre. At the theatre that Sunday night the test film was shown ahead of the main feature, in place of the usual "live" introduction by the theatre manager.

In the next issue of Smith's Weekly, film critic Kenneth Slessor praised it highly. He added that the sound quality was equal to, if not better than that on the big American feature! Thus encouraged, they added sound to a whaling film shot in Western Australia by Wally Sully.

By this time they had mounted the new sound recorder in a Reo panel van. Initially it was driven by a 240V synchronous motor, with a similar motor used to drive the camera. The camera was a converted silent DeBrie, of French make.

Using this setup they made a test film "on location" at Sydney Central Station. Prime Minister Scullin had just returned from London, and they filmed his arrival and speech. The motors driving the camera and recorder were powered by cables from the mains.

Then they added a DC motor to the van, so that the recorder could be run from batteries. A rheostat and tachometer were used to set the speed for 90ft/minute. In this case a flexible shaft was used to drive the camera from the same motor, so that the camera had to stay within a few feet of the van — either at the rear or on the roof. To try out this approach they went out to the Army camp at Holsworthy, and filmed a tank exercise.

The results of the test were so good that Managing Director Stuart Doyle decided they were ready to make a feature film. So early in 1931 he contacted Bert Bailey, the stage actor and theatrical entrepreneur, who owned the rights to the stage adaptation of Steele Rudd's classic rural melodrama "On Our Selection". It was arranged that Australasian Films would make a talkie based on the play, with Bert Bailey himself playing Dad Rudd, and with Ken Hall as director.

Production started in about June 1931. The interior shooting was all done

The Cinesound production team pictured in 1936, just after they had finished "Thoroughbred". The star of that picture, Helen Twelvetrees, is in the centre of the front row to the left of director Ken Hall. Arthur Smith is immediately above Ken Hall, but in the back row. Bert Cross is second from the left, at front.

Out at Sydney showground in 1938, while shooting "Ants in His Pants" with the comedian Will Mahony. Arthur Smith is at left, seated at the mixing panel.

first in the Bondi Studio, which was still being used at night as a skating rink. They built a small sound stage in the centre of the open area, leaving the rest free for skating! It measured about 10 x 6 metres, and was about 5 metres high. The timber frame was covered with heavy fibre-board on the outside, with a hessian lining on the inside covering a 150mm-thick layer of cotton seed hulls for sound absorption.

The studio had a motor-generator set capable of delivering 2000amps and 110V DC, which had been used to power lighting for silent film shooting. The arc lamps available were not really suitable for sound shooting, being too noisy. But they were forced to use them, supplemented by some makeshift floods using banks of 100-watt household lamps.

Just before studio shooting began, Arthur Smith finished a second sound recorder, which was used for these scenes. It was powered by a 240V AC synchronous motor, with a second

motor of the same type used to run the camera in synchronism.

The camera used for the studio shooting was a converted Bell and Howell. Like many silent-era cameras it was very noisy, so they had to mount it inside a sound-proof "bungalow" with an optical glass window in the front.

When the lights were turned on in the small sound stage, the temperature rapidly "took off", and soon hovered around 40 degrees C. It became particularly unpleasant inside the camera bungalow, and cameraman Wally Sully could only remain inside for short periods at a time.

While the studio shooting was being done, Arthur Smith was trying to work out a way of separating the camera and sound recorder for the forthcoming external scenes. They were going to shoot these at Castlereagh, about 55km west of Sydney. Many of the scenes would be well away from the nearest 240V mains, so synchronous motors seemed to be out. Yet the existing single-motor drive system fitted to the Reo van was too restrictive, as the camera could only be separated from the van by the length of the flexible drive.

He decided to try using a rotary inverter to generate 240V/50Hz AC from a bank of batteries, with a motor-generator to charge up the batteries at night, or between takes. The idea would be to drive the camera and recorder with synchronous motors, so that they would run locked. The correct filming and recording speed would be set by using a rheostat and tachometer to adjust the rotary inverter for 50Hz output. It looked as if it would be practical, so they ordered the rotary inverter.

In due course it arrived. But when they hooked the system together about four days before they were due to go on location, they found it wouldn't work. It was virtually impossible to set the rotary converter for constant speed at 50Hz. They were almost frantic.

By this time Clive Cross, Bert's young son, was acting as Arthur Smith's unpaid assistant. While they were trying to think of a way of solving the interlock problem, he remembered an old book describing early mechanical-scanning television systems and the methods used to synchronise the transmitting and receiving scanning discs. They quickly looked up the book, and Arthur Smith decided that one of the methods described might just provide the answer to their own problem.

It was a Saturday or Sunday, and all the electrical suppliers were closed. However they got one of the wholesalers to open up for them, and bought a couple of quarter-horsepower 32V DC motors. The Monday was a holiday, but they contacted the electrical firm Warburton-Franki who agreed to open their workshop and modify the motors for them on an emergency basis. Two sliprings were added to each motor, at the opposite end of the armature to the commutator. The sliprings were connected into the armature windings, at points 180 degrees apart on the commutator.

They collected the modified motors at about midnight on the Monday night, took them back to the studio and tested them on the Tuesday morning. One was used to drive the camera and the other the recorder, with both running from the same 32V battery supply. Rheostats were used to bring them up to correct speed, using a tachometer as before. Then when both were nominally at correct speed, a switch was used to connect the sliprings of the two together.

The idea was that with each motor running, its sliprings would be generating an AC signal of around 22V RMS (i.e., 0.7 times 32V), and with a frequency equal to the motor's rotational speed. On connecting the two sets of sliprings together, a heavy circulating current would flow if the two motors were at different speeds. The effect of the circulating current would be to bring the two to the same speed, and in angular phase lock.

Well, they tried it and it worked. On the Wednesday morning they were able to go out to Castlereagh and begin shooting the external scenes of "On Our Selection", and the hastily improvised DC interlock system worked without a hitch.

Not that there weren't problems. The drive motors were heavy, and that for the camera had to be mounted on a trestle behind the camera tripod. As the camera tended to jam, the flexible drive coupling had to be fitted with a "fuse" so that the motor wouldn't damage the camera when a jam did occur. The motor cables also had to be very heavy and unwieldly, to minimise voltage drops (later they would change to 110V motors, to allow the use of lighter cables).

The condenser microphone had arrived, complete with its preamp using a 201A tube in a rubber mount to minimise microphony. Property man Jim Coleman improvised a boom for it, using an old lamp stand and some timber, with a counterweight consisting of some housebricks in a box. It worked, although the construction didn't allow much movement during a scene — the actors just stood under the hanging mike, and Arthur Smith coped with the sound as best he could.

They had no "VU" meter, and although Arthur Smith had fitted the recorder with a signal rectifier feeding

a moving coil meter, its movement was too slow to be of much value. So he monitored the signal with headphones, and set the recording level so that the current meter in the plate circuit of the recording tube driver stage was just starting to flick upwards on signal peaks. This gave the best signal-to-noise ratio, while still keeping distortion low.

When the shooting was all done, they had to improvise at the editing stage as well. They had no Moviola, no sound reader, not even a two-gang synchroniser. But film editor George Malcolm worked with mechanical engineer Bert Wickens, and they managed to build some workable editing equipment together.

Finally they had the picture put together, and came up with the first complete answer print. One morning in June, 1932 Bert Bailey, Bert Cross, Arthur Smith and Ken Hall took the print with some trepidation into the Film House theatrette, for Stuart Doyle's verdict. Doyle was not just the managing director, but an experienced and canny showman. His reaction was crucial.

They needn't have worried. Doyle started to laugh soon after it began, and when it was over he jumped up beaming. Ken Hall relates that he took them all next door to Adams Hotel, to have a celebration drink. They had a winner!

"On Our Selection" was previewed shortly after that at the State Theatre, one Sunday night. The audience of 2,500 included the Press and many independent exhibitors from the suburbs and country. It rocked with laughter from start to finish, and the success of the film was assured. It went on to break all records for attendance and box office receipts wherever it was shown in Australia and New Zealand, and became a classic of the Australian cinema.

Assured by the success of "On Our Selection", the Cinesound team went on to produce all of the other films that are now so much a part of our cultural heritage. And Arthur Smith continued to make improvements to the sound recording system, in between the recording of the various films.

For the next film "The Squatter's Daughter", he worked out a way of mixing some music with the dialogue, using two theatre sound reproducers. He also designed and built a small equaliser, so that the dialogue could be emphasised relative to the music.

At about the same time he heard that the Americans had evolved the technique of "ground noise reduction" or GNR. This was the idea of reducing the light transmission through the film sound track during quiet passages, in order to minimise noise. He couldn't find out exactly how they were doing this at the time (it was by means of a shutter), so in typical Arthur Smith fashion he worked out a method for himself: a signal rectifier which varied the bias on the grid of the recording tube driver stage, with the appropriate attack and decay characteristics.

It worked well. In the absence of signal, the recording tube current was throttled back to give low negative exposure and a consequent darkening of the sound track on the final positive. During signal passages the tube current was automatically increased, giving a lighter track and the ability to cope with full modulation without distortion. So Cinesound films had the advantage of GNR very shortly after the big American producers began using it, thanks once more to Smith ingenuity.

When dynamic microphones appeared in about 1935, they were keen to change over to them because the condenser microphones with their preamps were restrictively bulky and heavy. But the dynamics turned out to have a response somewhat less suited for crisp speech recording, so they had to experiment with equalisation.

Back in 1930, when the first of the improved recorders was being made, Arthur Smith and Clive Cross had formed a private company — mainly to protect themselves in case of possible patent litigation. As time went by they made many different items of sound recording equipment under the Smith and Cross name, including both optical and magnetic recorders and reproducers, mixers and equalisers.

A Fellow of the Institution of Radio and Electronics Engineers Australia, Arthur Smith was honoured in 1971 by the Australian Cinema Pioneers Society as "Film Man of the Year", in recognition of his outstanding service to the motion picture industry. He has also been featured in Cinema Papers, the industry journal.

Like Ken Hall and both Bert and Clive Cross, Arthur Smith is still very much alive and well. He lives with his wife in quiet semi-retirement in the Sydney suburb of Bronte, overlooking the beach. He swims regularly, and likes to keep fit by jogging and stints on his home-built exercise bike. And he is still making movie sound gear — although the gear he makes now is a long way from that he designed and built way back in 1930. It's all silicon transistors and ICs!

Electronics has come a long way since 1930, and Arthur Smith has come with it. But looking back to the results he achieved then, under very primitive conditions, I think he has every reason to be proud. Don't you agree?

Arthur Smith (right) with Bert Cross, when both were guests at the "This Is Your Life" program featuring Ken Hall, in mid 1977. Both pioneers are hale and hearty, although Mr Cross is in his 90's.

NOTE: For those interested in reading more about the history of Cinesound, I can recommend Ken Hall's autobiography "Directed by Ken G. Hall" published in 1977 by Lansdowne Press. Also the article "Arthur Smith, Sound Engineer", in Cinema Papers, April 1974.

Television Watching COULD BECOME Meaningful!

Most TV programs don't say a thing to the millions of people who are deaf or have severe hearing impairments. But that situation may change.

Millions of Americans find television virtually meaningless. You can share their point of view: tune in your favourite program and then turn off the sound.

Unless you are deaf or suffer a severe hearing impairment, you have probably given little thought to what that disability implies.

Beyond the fundamental problem of communicating with people who hear lie more subtle problems. The deaf cannot hear fire alarms or sirens. They cannot use a telephone without an interpreter. And, with the exception of a few programs, they cannot enjoy television, our single most important communications medium.

But television watching could become a meaningful experience to millions of deaf Americans, in large part because of a new TV captioning system developed by the Time and Frequency Division of the National Bureau of Standards.

Captioning—the addition of "subtitles" to render spoken dialogue in print—has been in limited use for some time. A few private-network evening news programs and several programs on the Public Broadcasting Service (PBS) have been captioned for years, but such "open" captioning is employed sparingly because, for the vast hearing majority in the country, captions are a nuisance on the TV screen.

However, in 1971 NBS demonstrated a "closed" captioning system. The program captions were encoded in the television broadcast signal and could be seen only on a TV set equipped with a special decoder.

Originally this system was called "TvTime". The NBS Time and Frequency Division had found that the national television networks broadcast extremely stable signals that could carry time and frequency information with a high degree of accuracy. The researchers developed a way of encoding this information on the so-called "vertical interval", a normally unused part of the television signal (see box).

In October, 1971, TvTime was tested over the ABC-TV network in New York City. Besides transmitting a standard frequency, the system displayed the time on the screen and sent written messages to other ABC affiliates and to the NBS time and frequency laboratories in Boulder, Colorado. At the suggestion of ABC-TV it was decided to try using TvTime to carry captions for the deaf.

NBS and ABC-TV first demonstrated the closed captioning system in December, 1971, at a National Conference on Television for the Hearing Impaired, which was sponsored by the HEW Division of Media Services and Captioned Films at the University of Tennessee in Knoxville. Conference attendees saw an episode of ABC-TV's "The Mod Squad" broadcast with closed captions. The response was, as PBS later noted, "most favorable". One visitor at the conference wrote, "The National Bureau of Standards' demonstration ... was the highlight of the conference. This technical breakthrough might be considered the 'moon shot' for the millions who never heard the words 'one small step for man, one giant step for mankind' ".

A second demonstration was held the following February at Gallaudet College, Washington, D.C.'s famous school for the deaf and hearing impaired. The early captioning experiments were fairly crude, according to Sandy Howe, an information specialist with the NBS Time and Frequency Division who captioned a second episode of "The Mod Squad" for the Gallaudet demonstration. Working from an advance copy of the show's script, she spent two weeks coding the captions on a punched paper tape for transmission and "doing a lot of splicing and correcting misspelled words".

It played to an appreciative audience. Jim Jesperson, Chief of what was then the NBS Time and Frequency Dissemination Research Section, recalls: "Though the spectators were enthusiastic, nothing could match the growing excitement of the students as a whole new world opened up to them. Many motioned to each other with their hands; others had tears in their eyes as they watched the show. For the first time, they could actually understand the story."

In December of 1972, the Secretary of Commerce, on behalf of NBS, submitted a petition to the Federal Communications Commission (FCC), which would have to approve the use of time and program captions for broadcasts. The petition won the support of some industry and professional committees and several Congressmen, and it won the opposition of the three major networks, which argued that the proposed system needed more development and that the

Closed-captioning pioneers include information specialist Sandra Howe, who captioned television shows to demonstrate the NBS caption decoder, and engineer Dick Davis who supervised construction of the units.

TELEVISION WATCHING COULD BECOME MEANINGFUL!

continued

TOP: Captioning for the Public Broadcasting Service is done by Doris Caldwell. Working with a captioning "script" and a precise clock, Caldwell codes the times that each caption will be read from a computer memory. BOTTOM: Closed captioning is a popular cause with deaf NBS employees. Chemist Simon Carmel (right) signs his opinion that "people don't object to subtitles on foreign films, and if we can't have closed captioning, I would like to see hearing people accept the idea of open captioning." NBS photographer Mark Helfer acts as interpreter.

vertical interval space could be put to better use.

The captioning demonstrations and the FCC petition stimulated widespread interest in closed captioning, especially among the deaf and hearing impaired, and the Time and Frequency Division was deluged with requests for information. One teacher wrote. "We are greatly interested in what you have to offer. I have been in special education for over 37 years and this could be the greatest 'breakthrough' for deaf education that has ever come about." The Smithsonian Institution included the TvTime system in a 1973 exhibit on "Communication Barriers to the Handicapped" and originally scheduled it for a one year display. It is still being seen by thousands of visitors.

Meanwhile, the Public Broadcasting Service became interested in the closed caption system. Over a three-year period with funding from HEW and assistance from NBS, PBS technicians refined the system to make it more compatible with day-to-day programming. PBS modifications included some technical changes in the transmission format and improvements in the way the captions were displayed, such as the use of both upper and lower case letters. PBS also developed a mini-computer system to make it easier for a non-technical person to do the captioning.

A new petition, based on the PBS refinements, was submitted to the FCC in November, 1975, and the NBS petition was withdrawn to prevent confusion. The PBS petition came to the attention of President Ford, who directed the Office of Telecommunications Policy to "meet with appropriate persons in the public and private sectors to encourage voluntary implementation of captioning".

The most recent development occurred on December 10, 1976, when a unanimous FCC voted to allow PBS and other broadcasters to begin closed captioning service on a permanent basis. "We look forward to the day when all persons who suffer hearing impairments will be able to enjoy television programming. The decision reached here should go a long way toward achieving that goal," the Commission said.

Commenting on the FCC decision, PBS president Lawrence K. Grossman touched on the one remaining major obstacle to closed captioning: "Now that the FCC has spoken affirmatively on the need to provide full television service to this substantial portion of the population, the burden falls on us—and on all broadcasters—to work with equipment manufactured in developing popularly priced, off-the-shelf decoders within the

How "Closed Captioning" Works (NTSC system)

The television picture you see is a series of still pictures that combine, like a movie, to give the illusion of motion. Each picture in turn is made up of 525 interlacing lines which are transmitted and displayed on the screen one at a time to build up the complete picture. Thirty times a second a beam of electrons scans the face of the picture tube, going across each line once. There is a short period between successive pictures called the "vertical blanking interval" which is made up of 21 lines and corresponds to the horizontal black bar seen on the screen when the picture "rolls" out of adjustment.

Information for the picture caption is transmitted on — in this case — line 21 of this interval along with the regular picture. If the picture were to roll, the code would be visible as a series of dashes towards the bottom of the normally unseen black bar. They are "read" by the decoder and displayed on the screen. Currently, these captions can appear anywhere on the lower third of the screen, either on the right side or the left, which allows the captioner to give a rough indication, by where the caption appears, of who is speaking. The positioning information is also sent in code on line 21.

Some technical considerations at issue in closed captioning include data rate, multiple addressing of data, and adaptive equalization.

Data rate is the amount of data that can be transmitted within a specified time. This rate is determined by bandwidth — the frequency range over which information is sent. The broader the frequency spectrum (and the higher the possible data rate), the greater the possibility that noise will interfere with information. By decreasing the bandwidth, the signal-to-noise ratio is increased and decoding of data is substantially more accurate. The technical challenge is to find the optimum data rate, one that allows sufficient speed of transmission without noise interference.

Multiple addressing is the sending of different types of captions within the same bandwidth. It requires a relatively high data rate. With such a system, decoders could selectively read data at a certain "address" allowing, for example, the same show to be seen simultaneously on one set with English captions, on another with Spanish captions, and perhaps with weather or time and frequency information on a third. The decision on whether multiple addressing should be used has not yet been made.

Adaptive equalization eliminates the effects of "ghosts" or double images that can cause the caption decoder to make errors. The PBS system proposes using adaptive equalization, but some critics argue that the technique is not sufficiently developed and has not been sufficiently tested.

Another issue yet to be resolved is how well captioning will fit into regular TV programming. The present techniques and hardware have been designed for shows that are video taped, but a substantial amount of programming is either "live" or on film, mediums for which captioning technology is not yet well developed. According to HEW's Malcolm Norwood, the Captioned Films and Telecommunications Branch will probably fund more research in these two areas.

means of every hearing-impaired person in the country. PBS is committed to that objective. It is now time for all broadcasters to get together on the necessity to make captioning a basic ingredient of virtually all television programming."

The problem will be marketing closed captioning. At present, there are about 13 operating decoders in the country, all test models constructed for PBS under the supervision of NBS electrical engineer Dick Davis. PBS is currently looking for manufacturers who are interested in building and marketing the decoders—possibly built into special television receivers. But one of the opponents of the closed captioning petition was the Consumer Electronics Group of the Electronic Industries Association, a trade group representing all of the major manufacturers of television receivers.

Another question is whether or not the decoders—if built—would be used. Opponents of the PBS plan argue that it is only of value to the profoundly deaf—those who hear nothing—or to those with very severe cases of hearing impairment. This is closer to about 2 million than the often quoted 13.4 million figure which includes many people who have a hearing loss to some lesser degree. Persons who only suffer a degree of hearing loss would be better served by sound amplifiers, according to one argument. Proponents—including the National Association of the Deaf—reply that the sound distortion suffered by many of the partially deaf makes sound amplification useless for practical purposes.

The true figure for the number of hearing impaired people who need captions to understand TV is probably much greater than 1.8 million, the number of profoundly deaf, but under 6.5 million, the number of people with some degree of hearing loss in both ears, according to Marcus Delk, Jr., of New York University's Deafness Research and Training Center.

The number of persons who would use the system will affect the cost of the decoders if they are marketed. PBS estimates the added cost (above the normal retail cost of a TV set) at about $100—a figure which is also contested.

For the decoders to be useful, there must be programming carrying the coded captions. The only broadcaster currently doing this is PBS, which beams a couple of hours of captioned programming a week to the handful of test decoders installed in institutions for the hearing impaired throughout the country.

Of course, as decoders become available, the "market" for captioned programming will develop simultaneously. The reluctance on the part of industry today to capitalize on this innovation is reminiscent of the chicken/egg quandary of the early days of colour television: manufacturers felt that consumers wouldn't buy colour sets until a significant number of programs were being broadcast in colour; broadcasters thought it wasn't worthwhile to produce colour shows until a significant number of viewers owned colour TV's.

Today, captioned shows are mostly major-series programs carried by PBS. "The Adams Chronicles," for example, was broadcast with closed captions, as were some productions of the BBC's "Masterpiece Theatre," including the third series of "Upstairs, Downstairs" and Dorothy Sayers' "The Unpleasantness at the Bellona Club". Since last September, some children's programs have been captioned, including the "Once Upon A Classic" series.

Most of the captioning is done by Doris Caldwell, PBS' Coordinator of Programming for the Hearing Impaired, working with one assistant. "Our average for the first year and a half was about 15 hours to caption a 30 minute show," she says—considerably better than Howe's two weeks. "Since then it's gone down drastically. It now takes about 10 hours for a 30 minute show."

Caldwell chooses the programs that will be captioned. "What I've tried to do as the advance programs come in is to pick the real blockbuster programs ahead of time," Caldwell says.

PBS deliberately restricts the amount of captioning at present, according to Caldwell, because there are too few decoders to make closed captioning really worthwhile. For this reason, cap-

TELEVISION WATCHING COULD BECOME MEANINGFUL!

continued

tions that are sent out closed are also sent out at least once as "open" captions—part of the regular video signal. PBS tries to avoid too much open captioning so as not to jeopardize long-range project goals: mass production of decoders for home use and routine addition of closed captions by programmers on all networks.

Whether the commercial networks will adopt closed captioning is problematic since the three major networks opposed the petition before the FCC, arguing that more work needed to be done.

In addition to some technical objections raised to the design of the captioning system (see box), one or more of the networks argued before the FCC that the number of people who needed and would use the system was too small to make the effort worthwhile; that the number of shows that could be captioned was also too small (present technology only applies to shows on video tape); that the decoders would cost more than PBS estimates and be an unnecessary financial burden on the handicapped; that other systems are in development and it would be wrong to lock industry and users into one particular system before the others are tried; and that reserving an entire line of the vertical interval for this use alone, as PBS requested, would be wasteful.

The last objection, at least, has been answered by the FCC decision, which indicated that line 21 (the captioning line) could also be used to transmit other information, such as news, weather reports, and—the original NBS intent—time. A major manufacturer has already visited the Time and Frequency Division to dicuss the development of an integrated circuit chip for captions and time-of-day.

And cost may not be a problem for the handicapped, according to Dr. Malcolm Norwood, Chief of HEW's Captioned Films and Telcommunications Branch, which sponsored the PBS project. "We've been working on this for the last 3 to 4 years. Now after the FCC decision, we are considering putting into gear different plans, different options. One of these is possibly subsidizing at least some of the decoders. My office is exploring ways and means of making the decoders available to anyone whose hearing is impaired and who wants one," said Norwood.

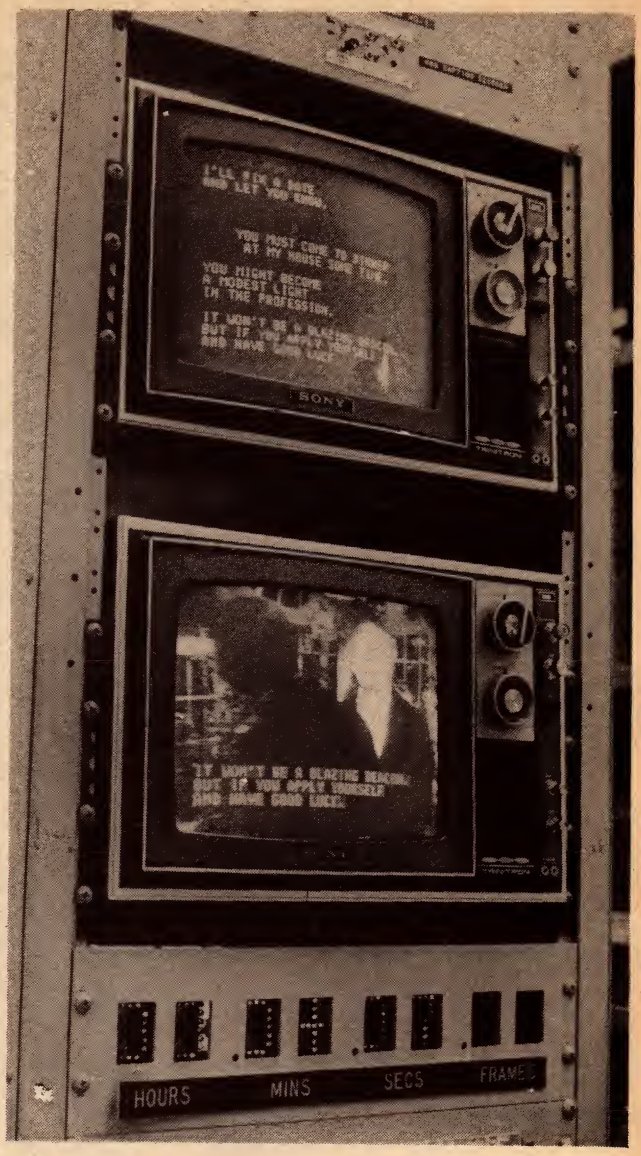
Norwood said that his office is also working on two other problems: encouraging networks to adopt captioning systems and planning seminars and training sessions to teach people to do the captioning. A good captioner must be able to time the captions right, be able to condense wordy dialogue without losing the sense of the exchange, write at the proper language level, and do it all efficiently.

In the final analysis, the human benefits from closed captioning may be well worth the costs. Among those who suffer the isolation of deafness and hearing loss, there is little doubt of this. Norwood speaks for many when he says, "I myself, as a totally deaf person, see this as a landmark. I see it as a way to help bring us into the mainstream of society. It will, I believe, have a tremendous effect on the young deaf child in particular. TV as we have known it has been a series of pictures without any particular meaning. Now we will be able to enjoy television as other people do."

And back at NBS, deaf workers have followed the development of TvTime with interest and hope. Jack Clair of the Boulder Laboratories print shop comments happily, "The deaf people will now be able to understand what's going on in the world".

Simon Carmel, an NBS chemist, looks beyond the use of closed captions for enjoyment and education to even more serious uses—such as the transmission of emergency messages. "Most deaf people have to wait until the next day or two days to get emergency news," he says. Carmel himself drove into Washington, D.C. during the 1968 riots, only to be stopped by the military, because he hadn't received the news that everyone else had heard.

"I'm very happy with the people at PBS who understand our problem," he says, "I feel the closed caption system is very helpful."



The photograph shows how captions are synchronised with the program on videotape. Captions for the program — a dramatisation of Dickens' David Copperfield — appear on the upper screen in sets of four. At the touch of a button, the lowermost caption appears on the bottom screen, showing how it will look on the final program, and a new caption appears on the top screen.

Reprinted from "Dimensions", Journal of the US National Bureau of Standards, Washington DC.

ANNOUNCEMENT

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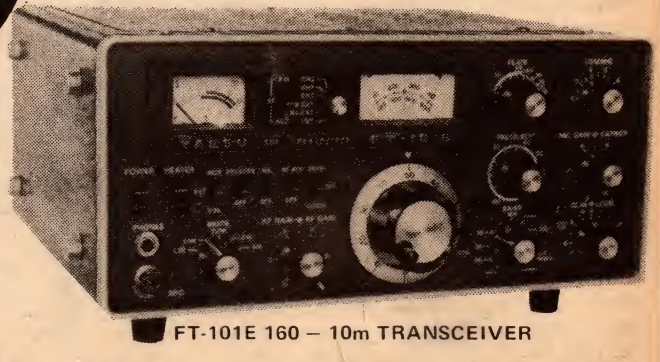

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Forum

Conducted by Neville Williams

Noise pollution: readers have their say ...

The sentiments expressed in "Forum" produce a variety of reactions, at times: concurrence, indifference and hostility. One thing is certain, however: the November Forum proved that the writer was not alone in his dislike of excessively loud sound from public address and theatre sound systems.

My remarks were not primarily aimed at the youth pop scene, where paralysing sound levels appear to be par for the course. Those who support such occasions at least know what to expect, even if they may not be aware of the damage that prolonged and excessive noise can do to their hearing.

I was more concerned with the way the loud sound syndrome appears to have penetrated "family" entertainment in restaurants, clubs, concerts and theatres. One goes to such places expecting a certain degree of discretion, and of concern for the comfort of patrons. Instead, all too frequently, one's ears are blasted with sound far in excess of what is appropriate; sound, dispensed "with all the delicacy of filling a wineglass from a bucket".

And here I should make reference to a small panel dropped into the December "Forum", which referred to a civic "Quiet Day" emphasis in Sydney. It read, in part: "And guess what was demonstrated: a gadget which would silence a P.A. system automatically if an unacceptable sound level was consistently exceeded."

The item was picked up from a press release but, unfortunately, in re-expressing it in a few words, we created an ambiguity.

Some readers thought we were referring to some kind of gadget which individual patrons could use to silence a too-loud P.A. system. They wanted to know how they worked, where they could be bought and for how much. Better still, whether we could describe how to build one in a future issue.

One's mind boggles at the ramifications of such a device. A single disgruntled patron, or a single non-sympathetic member of the audience, with such a device, could zap the P.A. system and leave film actors, entertainers or politicians substantially speechless, while technicians race around trying to unzap the system!

All we'd need then was something to zap the vocal chords of interjectors and bliss would be complete!

No, the gadget was something fitted to the P.A. system itself and pre-set in accordance with good taste, prudence or local government regulations. It would allow the system to be used normally up to the pre-set degree of loudness but would turn it off if a performer tried to beat the limit by shouting too loudly, for too long, too close to the microphone.

Sorry about that, but the other kind of gadget would certainly have made life interesting!

Getting back to the original theme, C.T. from Walkerville, in South Australia, expresses his sentiments in terms brief and to the point:

"If concert-goers did have knobs on the side of their head, as accessible as those on an amplifier . . ."

Thank you for your excellent article on sound reinforcement (?) in the November issue. I would like to express my complete agreement with every word you wrote.

Thanks G.T. for your support, and we pass on:

Matters which were specifically mentioned in the November article, the sound level in film theatres and from large pipe organs, were taken up by a reader from South Oakleigh, Vic, who happens to have been involved in both areas. After some preliminary remarks, which I have deleted for the sake of brevity, he says:

In my younger days, pre-CinemaScope, I worked as a city theatre projectionist. One buzz from the auditorium was a polite request for a little extra volume please, probably due to a full house; two buzzes was a rebuke — "You're blasting us!"; three buzzes for the cardinal sin — "Projection fault!".

Astute managers, faced with a restless patronage, would request reduced volume — in those days an effective way to keep audience noise to a minimum. In this age of ear-splitting, eye-ball popping holocausts I, for one, prefer not to attend the modern cinema.

Being also a small-time church organist, I am well aware of the mood factor associated with sound levels. The full diapason chorus, topped off with III rank mixture and tromba reeds from the swell is a glorious feeling, but only for a brief climax. For all round usefulness, the Salicionals, either alone or in 16, 8 and 4 ft chorus, with perhaps a little help from a quiet flute or gamba, is hard to beat. As Marcell Dupre has so ably shown, the grand organ relies on lots of delicate contrast to preserve its majesty.

In my opinion, we live in a sociologic disgrace, where the subtle combination of crowds, mood and sound volume has placed our culture on the edge of savagery.

I remember being in a large public hospital half a mile or so from the Melbourne Myer Music Bowl during a Pop Concert in the Spring of 1975. With two extra pillows jammed over my ears I could not make any significant reduction to the head-pounding racket late into the night.

On page 40 of the November issue the S500-D is advertised. What a marvellous piece of technology — bridged mono output of 900W into 5 ohms and intermodulation distortion less than 0.02% from 20Hz to 20KHz. I "dips me lid" to such brilliance in engineering and to all similar achievements.

But who needs it?

Place power of any kind, be it automotive, political, financial or

sound amplification in the hands of anyone and see if they can remain immune from the temptation to try it out, and having tried it, not become addicted, however slightly.

I am curious to know what became of "Scale Distortion", as described in my 1944 edition of the Radiotron Designer's Handbook. . . . "operation of the loudspeaker at a volume level other than that of the original sound". . . .

It seems to me that living under the glow of atomic explosions has produced some kind of madness which says eat, drink and amplify merrily for tomorrow we are nuclear fallout!

The earliest reading I can remember doing as a small child was a book of "Pop" cartoon strips reprinted from the Melbourne "Sun News Pictorial", circa 1935.

Pop was a genial and very portly gentleman, of whom his diminutive son asked:

"Pop, why can a man have only one wife?".

To which Pop replied:

"When you get older you will learn that the law protects those who can't protect themselves."

I am loathe to see any restriction on personal liberties, but I do believe the abuse of sound amplification has come to the point where the law should protect those who cannot protect themselves.

So let me know when you propose a silent demonstration in Martin Place, and I'll be there! Meanwhile, keep up the superlative value of THE electronics magazine.

With best wishes,
K. G.

A couple of points in this letter, not previously referred to, warrant brief comment. The first has to do with the emergence of very high power amplifiers for use in the home. C. G. asks: who needs them?

To be cynical it is probably trendy to have something more powerful than the 30 + 30 watts that might hitherto have been thought ample. The Jones' can sniff condescendingly at an ordinary piece of equipment but they certainly can't dismiss a system which provides a power output per channel well up into 3-figures.

However, there can be more to it than just that. Even operating at ordinary hifi listening levels, a big powerful amplifier can often impress with its "effortless" sound. I suspect that modest domestic hifi systems are often pushed into momentary overload on transient peaks, tending not only to crush the peaks but to distort what immediately follows as a heritage of the overload.

The tendency to design loudspeaker systems around less sensitive drivers has materially increased this possibility. A reduction of 6dB in loudspeaker sensitivity is equivalent to a 4 times reduction in amplifier power, so that 120

FORUM — continued

watts per channel is necessary to do the job that might hitherto have been done by 30+30 watts.

Fortunately, I think, the average hifi buff who invests in a high power system does so to banish any lingering suspicion of overload. Seldom is their ambition merely to produce a louder noise.

K. G. also raises the question of scale distortion — a departure from the subjective balance between bass, middle and treble frequencies when sound is heard in the home at a level different from that heard by a member of the audience at the original performance. If the level is too low, the bass seems to be lacking and, to a lesser extent, the treble. If the level is too high the reverse is the case.

I recall many an argument on this subject around the time the Radiotron Designer's Handbook was produced. One may question, for example, whether the scale effect can justly be considered a form of "distortion".

That point aside, some thought of it as a failing of amplifiers, whereas it is a purely aural effect, just as evident with live music as with the "canned" or reproduced variety.

Proceeding from this fact, it was often observed that concert goers do not, as a rule, wear acoustic headgear intended to boost or attenuate the bass and treble. They simply occupy their allotted seat and accept the volume level and the subjective frequency balance that results. Why then should listeners to an amplifier need to fiddle the sound balance?

The smart retort to that was that, if concertgoers did have knobs on the side of their head, as easily accessible as those on an amplifier, they'd most certainly twiddle them!

And then, of course, there were those who saw the whole discussion as pointless and impractical. Who would want, in their home, to recreate the full and original sound level of a symphony orchestra or a grand organ? In fact, there is no suggestion that they should. What is under discussion is the sound pressure level at the listener's eardrums and any likely original can be recreated with a large amplifier in a large room, a modest amplifier in a modest room, or even a pair of close-fitting headphones

The truth is that the matter of scale distortion is still very much with us, arguments and all. The difference is that it now goes under the more meaningful heading of "loudness compensation", sometimes introduced by a loudness off-on switch, sometimes built into the volume control circuitry, sometimes introduced by judicious use of the normal bass and treble controls. But, behind the "loudness" concept is the same set of Fletcher-Munson curves that inspired the earlier concept of "scale distortion".

Lastly, there is K. G's complaint about the problems of those who have to live, permanently or temporarily in the vicinity of venues using large public address systems. I can remember, personally, a lengthy stay in hospital, enlivened by announcements from a nearby night speedway. And a couple of nights in a country motel, trying not to participate in the town carnival!

A reader from the South Coast of NSW takes up this particular theme:

In the Greater Wollongong area are a number of sporting clubs built in residential areas. My wife and I recently attended one such club for a particular function. As we approached it, we could hear what the compere was saying from a block away and, to make matters worse, the language he was using left a lot to be desired. I am afraid that people have come to accept such noise levels as the norm. The next time I have to attend such a place, I intend to try out those small industrial ear plugs!

L. R. (Mt. Kiera, NSW)

Yet another facet of the subject is raised by D. C. of Beacon Hill, NSW.

I can assure you that there are many people who are worried about sound pollution.

As a musician (principally a composer) I am vitally concerned with sound and the effect that sound has on life (especially human). Such concern has also been recognised by others of the "new breed" of composers.

At the forefront of these is the Canadian composer R. Murray Schafer, who has written a number of books which are available from Boosey & Hawkes, e.g. "The New Soundscape" and "Ear Cleaning".

TO ROUND IT OFF:

Recently, the Sydney Morning Herald sought the reaction of its readers to the noise they encountered in everyday living. They came up with predictable hates: the noise of trains and buses, garbage compactor trucks, etc, and — top of the list — loud music and raucous advertising in shops and on television.

Amongst our own staff contacts and families, the noise in shopping malls and the "music" superimposed on it was voted as sufficient to ensure that they shopped elsewhere.

From the Sydney Daily Telegraph: A news item suggesting the likely end of the "The Who", reputed to be one of the World's loudest pop groups. The group's leader Pete Townshend is suffering with seriously impaired hearing!

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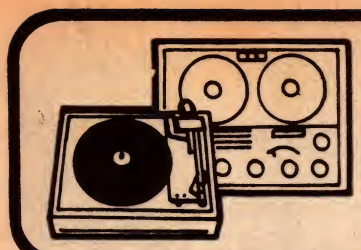

Hi Fi News

LOCATING PEAKS AND TROUGHS WITH AN EQUALISATION ANALYSER

At a function in Sydney, arranged by Audio Engineers Pty Ltd, Shure sales engineer Allen R. Groh presented an interesting and informative lecture on the subject of audio equalisation. The demonstration which climaxed the evening seemed to convince quite a few of the audience that they should take a further look at the idea, in respect to domestic hifi installations.

by NEVILLE WILLIAMS

For the sake of those whose memory needs to be jogged, audio equalisation normally involves the inclusion in the amplifier chain of a unit — an octave equaliser — which splits the audio spectrum into 10 or so adjacent segments. The gain in each segment is made variable, typically to ±15dB, making it possible for the operator to vary the frequency contour of the system, either to compensate deficiencies in the transducers or the auditorium, or to achieve a particular kind of sound balance.

From the context of the lecture, it was evident that the theme had developed naturally from the Shure Company's involvement in the professional sound reinforcement field, where efforts are commonly made to analyse the intrinsic response of public auditoria and to compensate the individual amplifier system accordingly, by one means or another.

Because of the layout and physical dimensions of auditoria, the reflective and absorbtive surfaces, etc, some parts of the audio frequency spectrum may tend to be exaggerated, others to be suppressed. The absorbtion may even vary on a short-term basis, according to the size of the audience present.

Assuming that the obvious major factors have been attended to — the choice and placement of speakers, microphones, etc — a logical next step is to incorporate an audio equaliser in the amplifier chain(s) so that individual parts of the spectrum can be boosted or cut, as necessary, to give the required overall response.

Typical of the equipment designed for this purpose is Shure's model SR107 Audio Equaliser, which offers a 10-octave coverage between 31Hz and 16kHz, with knobs providing ±15dB compensation at the centre point of each octave. A mono unit, with provision for rack mounting, the SR107 is clearly intended for professional situations.

Shure engineer Al Groh demonstrates the M615AS audio analyser in a PA situation.

But, like many in his audience, Al Groh confesses to being a professional by day and a home hifi enthusiast by night and it was inevitable that he should begin to ponder the shortcomings of his own domestic listening room. He took physical and electrical measurements, worked out standing wave modes, moved furniture around and experimented with stereo equalisers of one type and another, until satisfied that the sound actually reaching his ears was as flat as possible in terms of frequency response.

Fired up by the results, he wrote a paper on the subject for the Journal of the Audio Engineering Society (December 1974, p 795) and added it to his repertoire of things to talk about during his Shure promotional tours. That's how it came to be featured at the Sydney Hilton gathering, on behalf of Shure and Audio Engineers Pty Ltd.

Al Groh had, in fact, offered to talk about the Shure V-15 phono cartridge, with which he had been involved in the design stages, but Audio Engineers felt that it might be difficult to add to what had already been said and written about what is possibly the world's best known cartridge. Audio equalisation would be a subject of more interest.

The conventional attitude to domestic hifi installations is that one should aim for a system having the flattest possible frequency response and set it up in the largest available listening room. It is taken for granted that the room will have a significant effect on the frequency balance, particularly at the bass end, but this has to be accepted. One should be thankful that a pair of human ears can do a rather remarkable job sorting out direct from reverberant sound, thereby making the best of what might be a bad job.

But the whole point of Al Groh's lecture was that it needn't be that way. A dual-channel audio equaliser, providing a plus and minus control over discrete frequency bands across the audio spectrum, will allow a hifi enthusiast to compensate in part for the vagaries of the listening room — and possibly loudspeakers — giving a much improved overall response.

The concept is not new, of course, equalisers having been available for years in the hifi shops, intended for use with high quality systems. Al Groh was simply reinforcing the option but, in doing so, he also drew attention to a problem: equalisers are frequently used haphazardly and for the wrong purpose, creating as many problems as they solve.

So, what the enterprising hifi dealer, or the well-heeled hifi enthusiast needs is a new audio analyser just released by Shure. With it, they can resolve the problems of listening rooms, optimise loudspeaker and listening positions and set up a stereo equaliser by measurement rather than guesswork. And, if they happen to be in the quality public address business, the same technique

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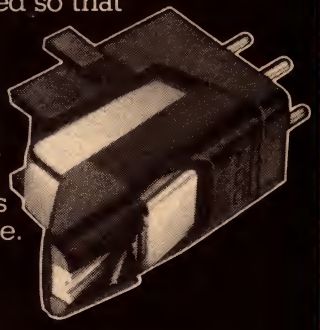

Less pressure means less wear.

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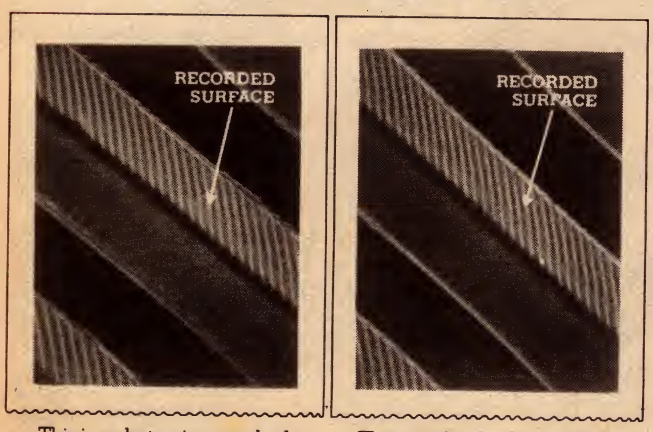
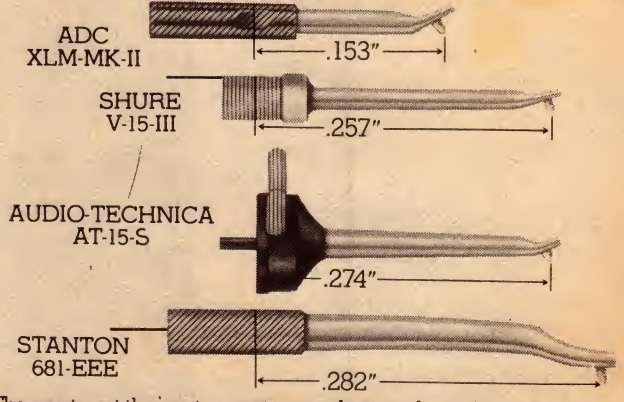


This is a photomicrograph of a 20kHz record groove that has never been played before.

This is a photomicrograph of a similar 20kHz record groove played 75 times with an ADC XLM-MKII cartridge. As you can see there is no difference.

THE DIFFERENCE:



The way to get the most accurate reproduction of sound is to lower the total effective mass of the moving parts of the stylus. And that's exactly what our engineers did. In fact, of all the leading brands, ADC cartridges have the lowest mass moving system you can buy.

INDUCED MAGNET

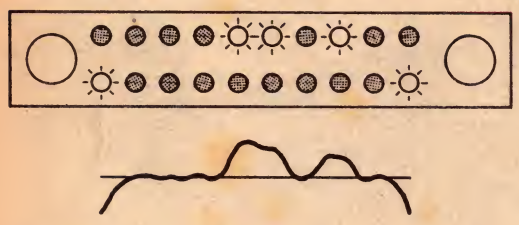
MAGNET

* CBS Technology Center Project 1108: Record Wear Test Program. Performed for Audio Dynamics Corporation. December 1976.

COMPTON BSR137

SHURE M615AS ANALYSER

Concentric knobs at the left control the pink noise output level to the amplifier system, and the microphone channel gain. The right-hand knob controls the dynamic hi/lo aperture for the LEDs, which glow above or below the appropriate octave calibration.



Peaks around 500Hz, 1000Hz and 4000Hz, and reduced output around 32Hz and 16kHz are indicated by the readout situation illustrated on the left.

can be used for such systems, as well.

Shure's new M615AS analyser consists of a special microphone type ES615, and a "black box" containing a pink noise generator, an amplifier and LED display which indicates whether the response in various parts of the spectrum is above or below some preset level.

"Pink" noise is produced by first deriving "white" or aperiodic noise from a diode or other such source, and reducing the amplitude, with rising frequency, at the rate of 3dB per octave. The resulting energy distribution across the spectrum then closely approximates that in wide-range program sound. The pink noise signal voltage can be varied, as necessary, and fed into an amplifier system at either "Mic" or "Aux" level.

With the hifi amplifier controls set for a flat response, the pink noise is then reproduced in the room at a level safely above the natural ambient but not so loud as to embarrass those conducting tests to to overload any part of the system.

The microphone is most logically placed close to the normal listening position in the room, and the gain settings adjusted so that the analyser can begin to display on its LED readouts those parts of the spectrum where the sound pressure level is above or below average. The dynamic range of the analyser can be adjusted for the most meaningful readout, from ±6dB at the wide setting, down to ±1dB.

Al Groh admitted that there could always be argument about microphone placement, on the basis that moving it a foot or so in any direction from the nominated listening position could modify results. However, the use of pink noise has an "averaging" effect on standing waves, so evident in sine-wave testing, and allows readings to be obtained which are certainly more meaningful and repeatable than subjective observations.

He went on to stress, however, that the wrong thing to do, having obtained a reading of room response, is to resort immediately to electrical compensation by the use of a spectrum equaliser. Even a relatively modest trough of, say, 6dB requires four times the power to compensate electrically; that kind of demand can rapidly push an amplifier or a loudspeaker into overload, trying to make up for deficiencies in a room.

In practice, at a resonant frequency in a room, the observed sound pressure level may vary by up to 15dB, depending on the source position and the listening position.

The proper thing to do is to try moving the loudspeakers or the listening position, or both, to smooth out the worst inequalities in the room response. Only then should resort be had to the equaliser.

In researching his paper, Al Groh took dimensional measurements of typical listening rooms and drew up a table of frequencies below about 400Hz for which those measurements represented multiples of half-waves. For example, a typical dimension of 4.2m (13.75ft) would be expected to produce a major standing wave or resonant effect at 40Hz, and lesser effect at other harmonically related frequencies.

As a further step, he drew node lines on floor and elevation plans of the rooms to show where loudspeakers could be placed to minimise room excitation for at least some of the major modes.

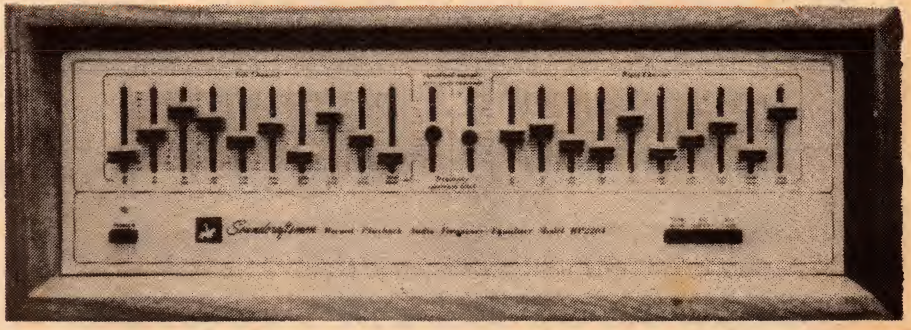
Typically, subsequent electrical measurement in a particular room showed a major response peak at 100Hz and this was identified as one which had been predicted at 98Hz; to deal with it, the loudspeakers were moved about 3ft out from the wall behind them, closer to the node for that resonance. This reduced the 100Hz peak but exposed another smaller peak at 138Hz, attributable to the floor-ceiling dimension. Raising the speaker off the floor by 1ft smoothed this one out and contributed towards a situation that could far more easily be dealt with by the electrical equaliser.

While not everyone would have the facilities or the expertise available to the Lecturer, he was able to make a few general observations which the audience found helpful.

If a loudspeaker system is placed against a wall, it works into a hemisphere rather than a sphere and this tends to increase the effective sound pressure level at low frequencies. Placing it adjacent to two walls increases the effect again, while putting it in a corner formed by two walls and the floor (or ceiling) reinforces the effective bass output to an even greater extent.

With a small speaker system, the bass reinforcement may be sonically impressive but since it can only take place at frequencies where the system has reasonable output, corner placement can lead to heavy emphasis of the

A TYPICAL STEREO GRAPHIC EQUALISER



A typical Soundcraftsman stereo graphic equaliser which can be plugged into the tape monitor link of most stereo amplifiers and receivers, while still giving access to the circuit for other devices. Its 10 octave sliders per channel give control of up to 12dB boost and cut over frequency bands between 20Hz and 20kHz. Signal/noise ratio is quoted as 96dB, and total harmonic distortion typically .05% at a 1V signal level.

100Hz region, and a very "boompy" result.

With a large speaker system, with an already reasonable bass response, too much bass reinforcement from the floor or adjacent walls can seriously unbalance the sound.

Al Groh also pointed out that, as distinct from low end reinforcement, one or more dips in the output can occur in the region around 200Hz because the distance from the woofer cone to an adjacent wall (or floor) surface and back again may approximate a half wave length at such frequencies. The reflected half-wave cancels the original wave, causing a dip in the response.

This should be kept in mind when moving loudspeakers in order to control the response at the lowest frequencies. Try to position them so that the airpaths from the woofer to adjacent surfaces are of different length, so that half-wave cancellation effects will be dispersed rather than coincident.

Ideally, the environment for each of the stereo pair of loudspeakers should be symmetrical to ensure balanced output at all frequencies and stable stereo imaging. Where the environment is not symmetrical, due to doorways, etc, the behaviour of the system can be considered one channel at a time and the most acceptable compromise sought.

As a rule, the listening position is less flexible, being usually near the centre line at the opposite end of the room. However, the seating may be arranged close to the wall, or a little away from it, as appropriate.

These observations are appropriate, of course, whether or not the listener intends to instal an audio equaliser. In the one case, optimising the room layout will bring its own reward; in the other, it will reduce the demands on the electrical circuitry, particularly where it may otherwise be called upon to cope with deep troughs or sharp discontinuities.

One point Al Groh stressed: an equaliser is not intended to replace the tone controls in a domestic hifi installation. Its proper role is to correct peculiarities of the loudspeaker system and the room, perhaps allowing a dB or so for known vagaries of the cartridge. Once properly set up, it really should not need to be altered unless there is a major change in the system.

Subjective impressions that the sound is a little bright or a little dull on some programs, or needs a touch-up in the bass end, are best met by use of the normal tone controls which can impose a smooth upward or downward slope, as required.

As a climax to the lecture, Al Groh fed the Shure M615AS spectrum analyser into the amplifier system being used and picked up the pink noise in the audience area with the analyser's own microphone. Some of the upper LEDs glowed, showing peaks, and some of the lower LEDs, showing dips. Appropriate adjustment of the corresponding frequency bands in the equaliser being used turned the LEDs off.

Narrowing the range limits of the analyser brought some of the LEDs back on again, requiring more critical adjustment of the equaliser to extinguish them and really flatten the system.

This done, a few musical selections were played with the equaliser switched in and out and the difference was quite obvious. No one disagreed that the equalised version sounded just that much more balanced but Al Groh added, as his opinion — and we paraphrase:

"For my complete enjoyment, the flat sound is a little on the bright side on some music. I'd roll it off a bit with the treble tone control."

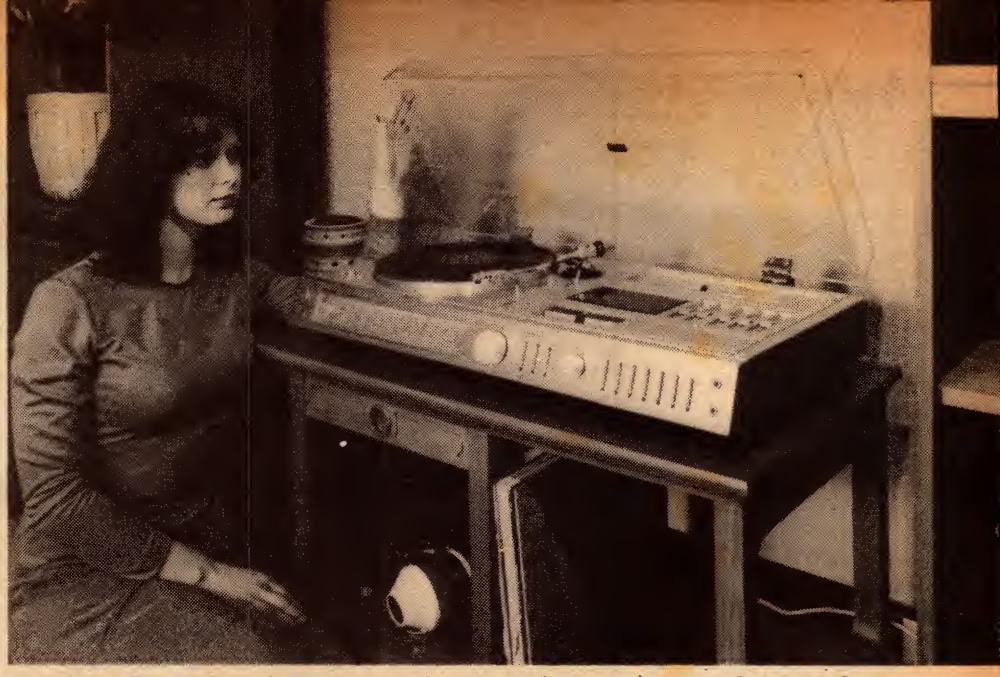
FOOTNOTE: We noticed an inquiry and an answer in an overseas publication which may shed some light on equaliser terminology.

The writer explained that the conventional "graphic" equaliser splits up the audio spectrum, typically into octaves, by using a number of fixed filters (eg 10). The only adjustment is of the signal level from each channel and, if this is controlled by a bank of slide pots, mounted side by side, the frequency contour is more or less evident from the position of the slider knobs — hence the term "graphic".

A "Parametric" equaliser is one which often uses fewer filters but adjustable in terms of centre frequency and bandwidth, in addition to amplitude. In setting up this type of equaliser, the "level" portions of the spectrum are ignored and the filters are adjusted individually to compensate specific peaks and troughs.

Filters which are fully adjustable — centre frequency, bandwidth and gain — are sometimes referred to as "smart". The non-adjustable type are, by contrast, referred to as "dumb" filters.

A parametric equaliser can be used in graphic mode provided it has enough filters and provided they can be set up to give a continuous over-lapping coverage of the total spectrum, as the "dumb" filters already do.



While conforming to the now popular 3-in-1 format, the new SM-3600 Stereo Music Centre by Toshiba-EMI has moved positively towards the hifi area with a belt-driven semi-automatic turntable, magnetic cartridge in a removable headshell, cassette deck with Dolby, bias and equalisation options, a tuner providing coverage for LW, MW, SW, FM and FM multiplex, and an 18W RMS per channel amplifier with full control facilities. Further details are available from Toshiba-EMI (Australia) Pty Ltd, 16 Mars Rd, Lane Cove NSW 2077.

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WT4/79

The strange case of the

TECHNICS A+ AMPLIFIER

Towards the end of last year, Technics announced the release of their new class A+ power amplifier, as pictured in our December issue. Intrigued to know what the term really meant, we arranged for our resident Sherlock Holmes, in the person of the writer, to interview the Japanese engineers in their home territory, in Osaka.

by NEVILLE WILLIAMS

Once again, Sungravure cartoonist Brian Evans insists that any resemblance between the characters portrayed and a couple of magazine editors from Sydney is entirely intentional!

As it transpired, several other Australian editorial Sherlocks converged on the same site with the same objective in view. Between us we came up with lots of clues but, in a most un-Holmes-like way, we had considerable difficulty in fitting them into a logical pattern.

No one was heard to say: "Elementary, my dear Watson!"

The Technics amplifier people had been warned beforehand that inquisitive visitors from Australia would be asking about class A+, as envisaged by my observation in the December issue: "By the time you read this, I may have been able to put the questions directly to the engineers involved. . . ."

But two problems arose:

The first was that the Japanese engineering staff assigned to explain the principles to us — in English — did not pitch their initial presentation at an adequate level for editors who needed, later, to write for a technical readership. It would have been more appropriate for hifi merchandisers, needing only a broad outline to back up their sales literature.

When we began to probe more deeply, the second problem intruded: the language barrier. It became acute when we began to speculate on the possible similarity between the Technics class A+ circuit and the QUAD "current dumping" amplifier — an odd enough term in English, let alone what it might turn out to be in Japanese!

When it became clear that we were going around in linguistic circles, we re-framed our speculation into a specific question, to be answered in a later session:

How does the class A+ amplifier really work and is it similar in concept to the QUAD approach?

These remarks are not intended as a criticism of the Technics engineers. Their knowledge of English was a lot better than ours was of Japanese. I knew "sayonara", "poppasan" and "odomo". Somebody else could express "thanks" and "good morning" and count all the way to 10. But that was about our limit!

In the second session, a couple of days later, the engineers came up with a series of sketches, illustrating the operation of several amplifier output stage modes for both low level and high level signals. It closely paralleled the opening theme of our article in the December issue.

They pointed out that, in the classic transformer-coupled push-pull class A stage, the output devices were biased to draw half the peak current they would be called upon to deliver at full power. Both devices contributed equally to the final output over the whole signal cycle, at either low or high amplitude. Intrinsic distortion was low, but the demand on the power supply was heavy and the dissipation embarrassing for higher power amplifiers.

In a class AB amplifier, the quiescent demand on the power supply is reduced by biasing the output devices somewhere between the class A condition and cut-off. A class AB amplifier operates like a class A amplifier for low signal levels but, for higher signal levels, one output device tends to cut off during alternative half-cycles, whilst its opposite number conducts heavily and delivers most of the output power on its own. This transfer of the high-level workload from one output device to the other on successive half-cycles is a potential source of distortion, needing to be combated by critical circuit design and heavy reliance on negative feedback.

A class B amplifier carries the thinking a step further with both output devices biased very close to current cut-off. At virtually all signal levels, low or high, the output is delivered from the respective devices alone on alternative half-cycles. The very low standing current offers a considerable economy in power supply design and dissipation, but the abrupt transfer of the workload from one device to the other tends to produce a switching transient (or switching distortion) which may defy either design or negative feedback to eliminate completely. Being a fairly constant component of the output signal, it is most likely to constitute a significant and perceptible percentage of distortion in its effect on low level signals. It provides the most likely reason why enthusiasts tended to reject early transistor amplifiers on the grounds that, while they had plenty of power, they lacked "sweetness" at ordinary listening levels.

Proceeding to answer our specific question, the Technics engineers acknowledged that the QUAD current dumping amplifier offered an interesting answer to this last-named problem in that it used virtually two output stages in parallel. A small class A amplifier delivered power to the load (the loudspeaker) for the initial signal excursion either side of the zero line. Before the signal reached an amplitude sufficient to overload the class A amplifier, it drove into con-

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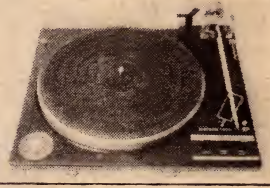

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The strange case of . . .

THE TECHNICS A+ AMPLIFIER

duction one-half or the other of a heavy-duty class B stage which supplied the necessary signal current to the load over the remainder of the signal envelope.

While the Technics engineers were hesitant about criticising a competitive product, they indicated that, while the QUAD scheme did eliminate switching transients from the zero crossing region, there was a danger of the transients reappearing, in some form, part way up each signal envelope, where the class B stage took over.

When we pointed out that the voltage envelope from the class A amplifier was continuous and that QUAD engineers had put forward maths to validate their particular negative feedback arrangement, the Technics representatives countered with a few "yes, buts. . . ." and deflected further discussion. Their job was not to argue the merits and demerits of somebody else's amplifier, but to talk about their own, which they felt to be a newer and further step towards the ultimate.

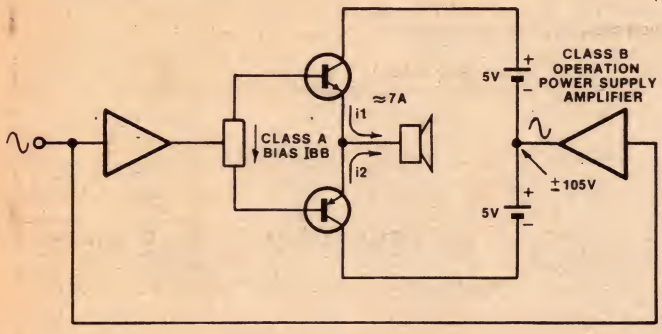


FIG. 1

The first basic diagram put up on the board by Technics engineers in Osaka. Initial guesses as to how it worked proved wrong. The explanation set out in the accompanying text appears to fit all the clues which have managed to filter through the communication barriers between the Japanese engineers in the Technics labs and our own editorial desk.

So we turn back to the basic diagram (Fig. 1), which they had displayed on the board two days earlier and which had been the centre of so much discussion. It shows the incoming signal passing through a low level amplifier, and thence to a class A power stage driving the loudspeaker, and operating from a split power supply of + 5V. The incoming signal is also fed to what is shown as a class B power supply amplifier connected to the junction of the two 5V supplies.

In the SE-A1 stereo amplifier there are, of course, two such systems, one for each channel.

Struggling to bridge the communications gap, our first reaction was to say: ah yes! The class B amplifier injects voltage in series with the +5V and —5V supplies, boosting them respectively to +110V and —110V, preserving the balance of the class A amplifier and allowing it to handle large peaks of signal. But please: two questions. . . .

Shouldn't the connection between the two 5V supplies be broken to allow supplementary voltages to be injected in series with each supply? Assuming this to be the case, is the rise time of the class B amplifier fast enough to match the transient requirements of the class A amplifier?

Whether or not the Japanese engineers understood all the words, they certainly reacted when we tried to modify their drawing to show branching lines from the class B amplifier to the two power supplies.

No way! The junction was a single common point being driven at signal frequency between the limits of ± 105V.

So the Australian party went into another huddle and came up with a second flash of inspiration: maybe the class B amplifier simply delivered power to the load through the series impedance of the 5V supply and each output transistor in turn? A "series" version of the QUAD design?

When we got this idea across, it was denied just as positively. The collector impedance of the class A transistors is so high that no useful current could be fed back through them into the load in that simplistic fashion.

Only then did the real message begin to seep through and it was confirmed later by a somewhat expanded basic diagram (Fig. 2) which I came across in an all-Japanese brochure.

At low signal levels, output is delivered from the class A stage, operating in conventional mode, predominantly from its own balanced +5V and —5V supply. The centre point of the supply is not directly grounded, but floats at near-ground potential under quiescent or near quiescent conditions.

A natural reaction is to wonder about the power output capability of this basic and much-vaunted class A amplifier. How much power can it deliver to the load before the big class B (and maybe suspect) stage gets into the act? The QUAD design invited exactly the same speculation.

In the case of the Technics amplifier, and looking at Fig. 1, the most meaningful estimate would be to allow for a 1V drop across each output transistor, suggesting a maximum peak-peak voltage swing across the speaker of 8V. This is equivalent to about 2.8V RMS, or 1 watt when referred to an 8-ohm loudspeaker.

This is a surprisingly small figure when compared with the quiescent input to the class A amplifier (10V x 7A = 70w). Clearly, the class A output transistors are very heavily forward biased for another reason and this, in fact, turns out to be the case.

Technics engineers pointed out that the class A amplifier never does work in isolation. The same signal which drives it is also fed to the high power class B "power supply" amplifier. In the presence of signal, the class B amplifier begins to swing the floating centrepoint of the two 5V supplies at signal frequency and in such polarity that it adds

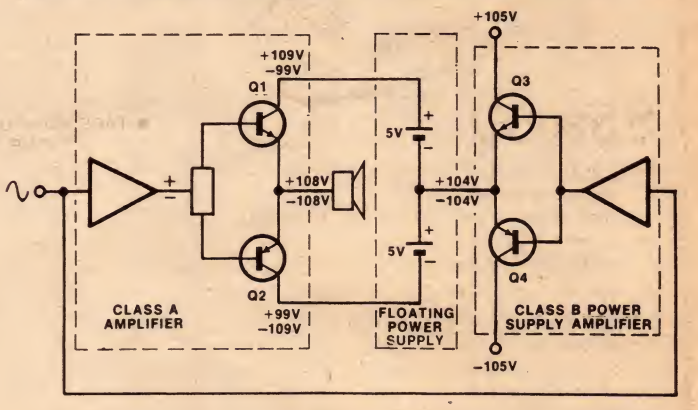


FIG. 2

A somewhat more detailed explanatory diagram extracted from a Japanese leaflet. The significance of the various voltages is explained in the accompanying text.

to the supply of the transistor which is passing through the upward current half-cycle. Thus, if the base of the upper class A output transistor in Fig. 1 is being swung positive, causing it to draw more current, the class B power supply amplifier will proportionately augment the voltage applied to its collector.

A couple of statements which emerge from this discussion were to the effect that, through generous use of negative feedback, the class A and class B amplifiers have exactly the same gain relative to the common input signal. Further on a conceptual basis, the 5V supplies look after the voltage drop across the class A transistors, while the class B system supplies the voltage across the load.

These observations start to make sense once the basic operation has been grasped.

Let's look at the more detailed diagram, Fig. 2.

The strange case of . . .

THE TECHNICS A+ AMPLIFIER

Taking the extreme case, consider that a full positive-going swing is applied to the upper class A transistor, Q1, so that there is a cyclic increase in it's collector current. Simultaneously, the signal applied to the class B power supply amplifier cycles the upper class B transistor Q3 into full conduction, adding +104V (105 — 1 V) in series with the +5V supply and carrying the collector of Q1 to +109V (the upper set of figures). In turn, the emitter of Q1 will cycle towards +103V, which will be applied to the loudspeaker.

On the alternative half-cycle, the position reverses. The collector of Q2 cycles from —5V towards —109V, and the emitter to —108V (the lower set of figures).

The figures suggest an absolute peak-peak audio voltage across the loudspeaker of 216V, equivalent to about 76V RMS. Across 8 ohms, this would represent a power level of well 700 watts, or double that figure into 4 ohms!

These two figures are fascinating in that they indicate how far such a system could be pushed in the absence of limitations on device and supply current — and of prudence! Technics engineers have obviously applied constraints to the design to limit the rated output for 0.003% distortion to a mere (!) 350w into either 8 ohms or 4 ohms. This corresponds to +75VP across an 8 ohm speaker or +53VP across 4 ohms.

Okay, fine! But what happens to each class A output transistor during those half cycles when its supply voltage is not being augmented? Intuitively, one might expect a reversal of supply polarity, but this is not the case.

Looking again at Fig 2, it will be noted that the collectors of Q1 and Q2 have a fixed 10V differential by virtue of the floating power supply. Thus, when the collector of Q1 peaks at +109V, the collector of Q2 peaks at +99V. But the emitter is at +108V, so that, as the base is cycled towards cut-off, the effective collector — emitter voltage actually increases.

And here the reason emerges for the very high forward bias on the class A stage: by setting the current at 7A at a 5V supply, quite a large signal swing can be accepted before the transistors approach cut-off, particularly with the collector-emitter voltage cycling upwards at the same time.

In fact, an isolated reference in the scattered and sparse English-language literature confirms that the peak current of the conducting transistor is 14 amps so that, over the whole cycle, Q1 and Q2 cycle somewhere between the limits of 14 amps and close to 0 amps.

So we proceed to a tentative summary — tentative because we have not seen a circuit, a manual, or even a published analysis of the system, at the time of writing. Nor have we had much success in getting lucid translations of Japanese leaflets.

- As a basic balanced circuit, the class A amplifier could deliver only a very limited power to the load, probably much less than 1 watt. The design depends on the fact that, with any signal input at all, its capabilities will be boosted by synchronous power fed to it from the class B amplifier.
- Q1 and Q2 might actually be considered as emitter followers coupling the input signal to the loudspeaker load. On alternate half cycles the collector voltage to each is augmented by the class B amplifier to allow it (Q1 or Q2) to cope with the large upward swing in collector current.
- Both output transistors do apparently conduct through the whole input cycle and, in this respect, justify the description as class A. However, the selective supply voltage boost to each output device on alternate half-cycles is a further step away from the traditional view of a class A stage: no current cut-off, plus stable supply voltage and complete symmetry. Besides being more marketable, Technics choice of the term class A+ seems nevertheless to be justifiable and certainly a lot more meaningful than the choice of yet another arbitrary letter: class L,M,N, &c.
- Based on the above statements, there should be no switching phenomena in the main signal path, and therefore no switching distortion. To judge by the ratings, negative feedback has looked after other distortion components very effectively indeed.
- The quiescent power load of the class A amplifier (circa 70w), plus other circuitry is quite manageable. The class B power supply amplifier which basically supplies the watts for the loudspeaker load (up to 350w per channel) is no different in its demands from any conventional class B amplifier of comparable power rating.
- Leaving aside the obvious language difficulties, there would be scope for an interesting debate between champions of the QUAD and the Technics approach. Both started off with the same goal. QUAD ended up with a low-power class A and a high-power class B amplifier in parallel; Technics have put them in series and opted for a much higher powered unit. They say, however, that the class A+ approach would make sense for stereo amplifiers rated from 80+80w upwards.

One final point:

In the discussion, we felt that we had spotted one fundamental loophole in the Technics approach.

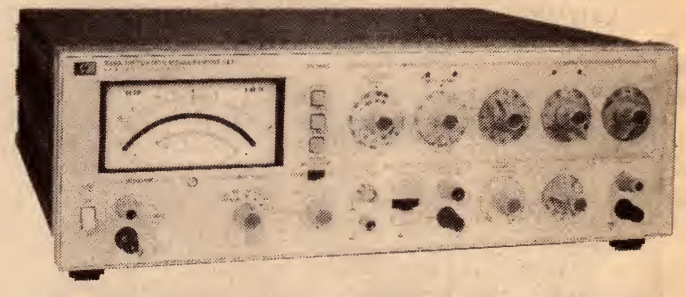
The whole design proceeds from the assumption that a class B amplifier can never be perfect. How can you feed the imperfect output from a class B amplifier into a class A system without compromising the latter's performance and defeating the whole purpose of the exercise?

Technics engineers answered this by drawing on the board a family of collector curves: collector current against collector voltage for different values of base bias. They pointed out that device transconductance and collector current are substantially independent of collector voltage, but heavily dependent on base bias.

Even if the collector supply voltage from the class B power supply amplifier contained some distortion, it would not appear as a component in the class A amplifier collector current driving the loudspeaker. The current through the class A amplifier is almost entirely dependent on the base (i.e., signal) current.

Point made! And there we leave the class A+ amplifier until some possible future occasion.

Distortion Measurement Set



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Realistic Lab-400 turntable

The Realistic Lab-400 direct-drive automatic turntable has two motors. One drives the platter, while the other drives the arm mechanism which uses a reed relay for end-of-record sensing. The Lab-400 has two speeds and is supplied complete with cartridge and cover.

In appearance, there is little to differentiate the Realistic Lab-400 from other well-finished turntables of Asian origin. The tone arm is of the familiar S-shape with removable headshell and adjustable counterweight. The platter bears prominent stroboscope marks which are illuminated by a neon light. The plinth is finished in "walnut grained vinyl veneer", to quote a sticker on our sample.

Overall dimensions are 450 x 150 x 370 mm (W x H x D) and mass is 7.2kg. Clearance of 50mm is required at the rear of the plinth to allow the tinted perspex cover to swing up. The cover is easily removable and has spring loaded hinges. The plinth has large shock-absorber feet which look as though they are adjustable, although they are not. They provide good acoustic isolation, however.

On the left-hand side of the plinth are the speed selector and two speed adjusting verniers.

On the right-hand side of the deck are the other controls. Rearmost is the damped cueing lever. In front of that is the disc diameter selector and right in front is the main control lever which has three positions: Start/Reject, Off and Start/Repeat.

Effective length of the tonearm is 220mm. It is statically balanced with a rotatable counterweight which also provides the tracking force settings, up to four grams. This is really too large a range of tracking force. There are few cartridges of good quality which require more than two grams, and they would be unlikely to be used with a turntable in this price bracket.

As a result of having to provide a wide tracking force range with the counterweight, the calibrations are rather coarse. With ½-gram steps, the arm is difficult to balance precisely.

Accuracy of the tracking force calibrations appears to be within ±10% while the anti-skating settings appear to bear no relationship to the tracking settings. The anti-skating does not appear to work at all for settings below about "2".

The cartridge supplied is branded Realistic R-1000E and is made by Shure. It does not appear to be equivalent to any of the regular Shure models and in any case it is difficult to make comparisons since the specifications quoted by Realistic are vague and incomplete. Not quoted are cartridge resistance, inductance, recommended load and required shunt capacitance. The stylus is described as a "0.7mil diamond". Recommended tracking force is 1 to 1¼ grams.

Perhaps the most interesting feature of the Lab-400 turntable is not the fact that it has a 16-pole DC servomotor providing direct-drive to the platter, but the second motor which drives the arm set-down and return mechanism. Realistic do not mention it at all in the owner's manual, and little mention is made in advertising material. Whether it provides any advantage over competitive models is not clear.

A three-core mains cord and moulded three-pin plug is fitted for connection to the 240V mains supply. Capacitance of the signal cables is 100pF in each channel, so CD-4 cartridges can be used.

Operating the turntable reveals one major drawback — it is not possible to use it as a manual unit. To start the platter revolving, the unit must go through the Start cycle with the stylus setting down in the run-in groove. Similarly, to stop, the unit must go through the Stop cycle. Merely returning the arm to rest by hand will not switch off the platter motor. However, once the motor is running you can select tracks and use the cueing lever.

In operation, the arm mechanism is always quiet and gently lowers and lifts the cartridge, although when the arm is traversing the motion looks a little jerky. The cartridge is muted during the Start and Stop cycles.

We measured wow and flutter of the Lab-400 as 0.13% (DIN 45507), which is quite a creditable result. Rumble was not quite up to the standard we have come to expect from the best turntables, but was still quite good.

Frequency response with 47k load was within +2dB from 20Hz to 20kHz and separation was better than 30dB in both directions at 1kHz. Waveform was good over most of the range. In short, a good performer.

The Realistic/Shure cartridge performed very well in tracking tests at the maximum recommended setting of 1¼ grams. At this setting it handled the +16dB drum test track of W&G 25/2434 with only slight mis-tracking, and also did very well on the Shure Audio Obstacle Course disc.

In summary, the Lab-400 seems to be quite reasonable value for money, taking into account the supplied cartridge. However, we would like to see the arm further refined and the controls revamped slightly to allow fully manual operation if desired.

Recommended retail price of the Lab-400 turntable is $299.95. The unit is available from Tandy stores throughout Australia. (L.D.S.)

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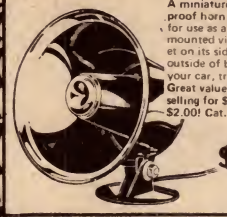

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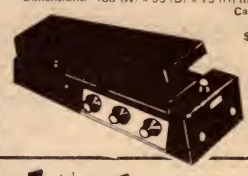

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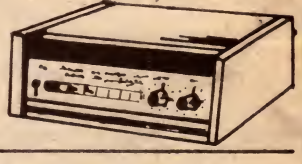

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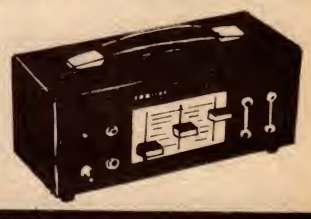

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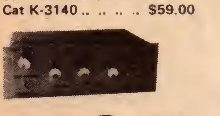

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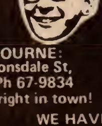

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Playmaster stereo cassette deck

The first stereo cassette tape deck we described was very popular, and we think this new design will find the same reception. It is based on a new top-loading mechanism which comes complete with most of the basic electronics. The complete circuit offers good overall performance, generous drive for stereo headphones and dual LED monitors for signal level indication.

by LEO SIMPSON

Under normal circumstances, no-one would attempt to build a cassette deck. The flood of Asian imports makes it far more practical and economic to purchase one complete rather than "roll your own". Nevertheless, a fair number of our readers are interested in this sort of exercise and we have now been able to base a project on an OEM cassette mechanism imported from Hong Kong by (believe it not) Dick Smith Electronics.

For those who have been tantalised in the past by this unpronounceable jargon, OEM means "original equipment manufacturer'. This means that this particular cassette deck, the Yocom 1000, was probably designed to suit a particular manufacturer's requirements.

The Yocom 1000 cassette mechanism incorporates most of the electronic circuitry required to make a conventional stereo cassette deck, without Dolby noise reduction. The mechanism has a plastic escutcheon which carries the control legends and also has a built-in compartment for temporary storage of three cassettes. There is a three-digit tape counter. Six piano keys control the mechanism operation. The keys are: Record, Rewind, Fast Forward, Play Stop/Eject and Pause. The Stop/Eject key has a two step operation: Press once to stop the tape; press again to eject the cassette. The Pause key operates by lifting the pinch roller away from the capstan, and leaves the motor and circuitry running.

An auto-stop facility is provided by a motor-driven ratchet system which operates at the end of recording or playback of the cassette. It does not operate during Fast Forward or Rewind.

The motor runs from 9V DC and incorporates a speed control circuit. Current drain ranges from 60 to 150 milliamps depending on operating mode and manufacturing tolerances.

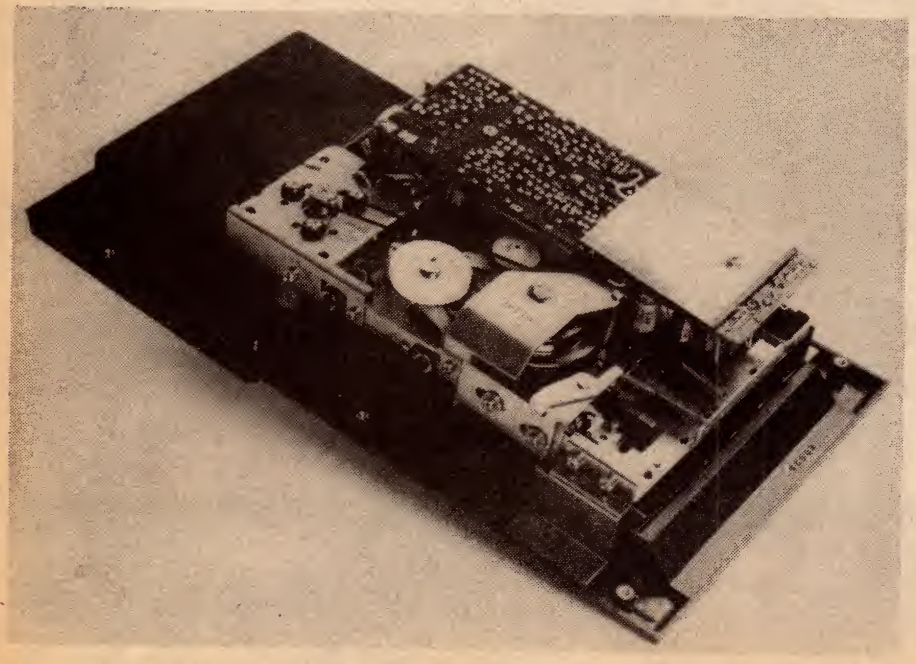
The electronic circuitry is carried on a tightly packed PCB on the underside of the mechanism. The circuitry, comprising twelve transistors and two diodes, is fairly conventional. A common amplifier circuit is used for recording and playback with fairly complex switching to change from one function to the other.

An automatic level control feature is provided which acts to reduce the gain of the amplifier (in the recording mode) when the output signal rises above a pre-determined threshold. The circuit comprises D101, D201, Q105, Q205 and Q301 plus associated passive components. As may be seen from the circuit of the Yocom 1000 there is no provision for switching the ALC facility off.

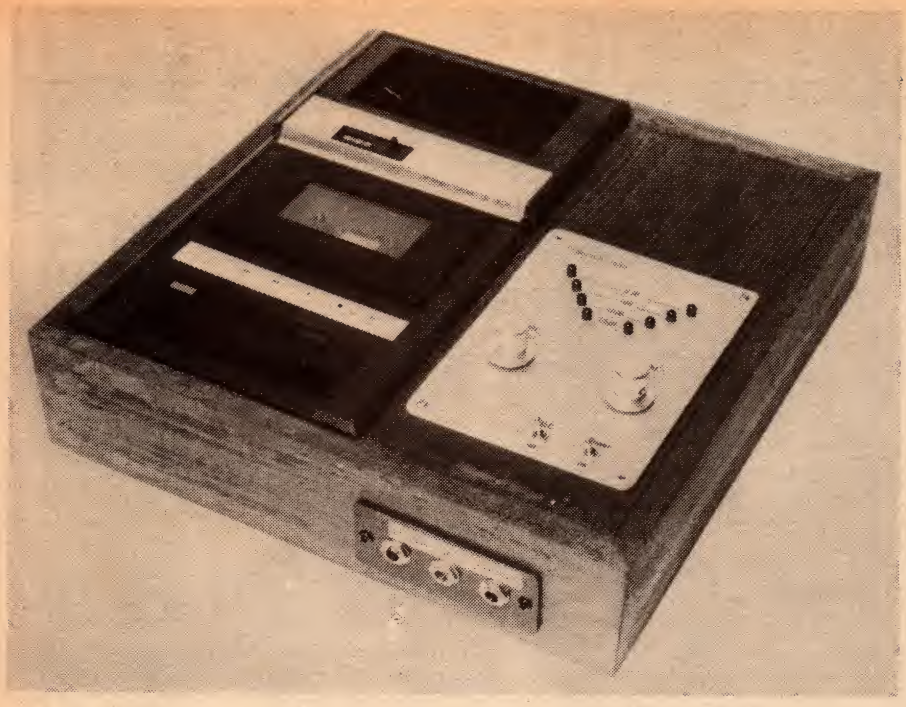
A transformer-coupled oscillator employing a single transistor provides bias and erase voltage at 60kHz, a figure which is not particularly high by modern standards but quite adequate.

There is no provision in the existing Yocom circuitry for recording or output level controls, signal metering or headphone outputs. We have produced an adaptor PCB to provide these facilities, plus the required 9V supply. Building the complete deck is thus a matter of obtaining the Yocom mechanism, making up the adaptor PCB and assembling the lot into a suitable case together with hardware such as the power transformer, sockets and switches.

Quite a few interconnections are required between the Yocom PCB and the adaptor PCB, the sockets and controls. To enable this the copper pattern



The Yocom 1000 deck mechanism (left) forms the heart of the project. Most of the electronic circuitry required is integral with the deck.



of the Yocom PCB has to be cut in a number of places. The first cut involves the ALC circuit.

The junction between the two diodes, D101 and D201, and the 10k resistor, R309 must be broken. As shown in the photograph of the Yocom PCB, this involves a small copper pad to which these three components are terminated. Cut it as shown in the photograph. This disables the ALC. Later a switch will be connected to the two sections of this bisected copper pad to enable the ALC to be switched in or out.

The other cuts involve the output of Q104 (and Q204 in the other channel) to S105 which is a section of the record/playback switch. This switch is operated when the Record key is depressed. At other times the circuit is always in the Playback mode whether the tape is moving or not.

Cut the copper track from the junction of R127 and R128 to S105B. The output from Q104 via C118 then becomes the input to the 10k level control from which it feeds to the adaptor board. A similar cut is made in the circuit for the other channel.

The Adaptor PCB has measurements 110 x 140mm and is coded 77c2. It is designed specifically to mate with the Yocom 1000 deck and is not likely to be suited to any other deck.

First stage of the adaptor is a single low-noise transistor connected as an emitter-follower. This buffers the output of the 10k level control so that it can be fed back to S105B and its associated head feed circuitry. Output from the emitter-follower is also fed to the LM380, which functions as a headphone driver. Since the LM380 is normally used in audio amplifiers putting out a couple of watts it has no trouble providing generous drive to the headphone socket.

The generous headphone drive is a feature not found on many high price cassette decks. These are often hard put to drive ordinary 8-ohm phones to a respectable level, let alone high impedence types.

We used the 14-pin version of the LM380, which is slightly dearer than the non-compatible 8-pin version. The 8-pin version is quite suitable for this application but, according to NS Electronics Pty Ltd, it is in relatively short supply and likely to remain so.

Voltage gain of the LM380 is internally fixed at 50. No voltage gain is actually required of it in this circuit, so the output of the emitter follower is passed to the LM380 via an attenuator consisting of the 10k and 220 ohm resistors.

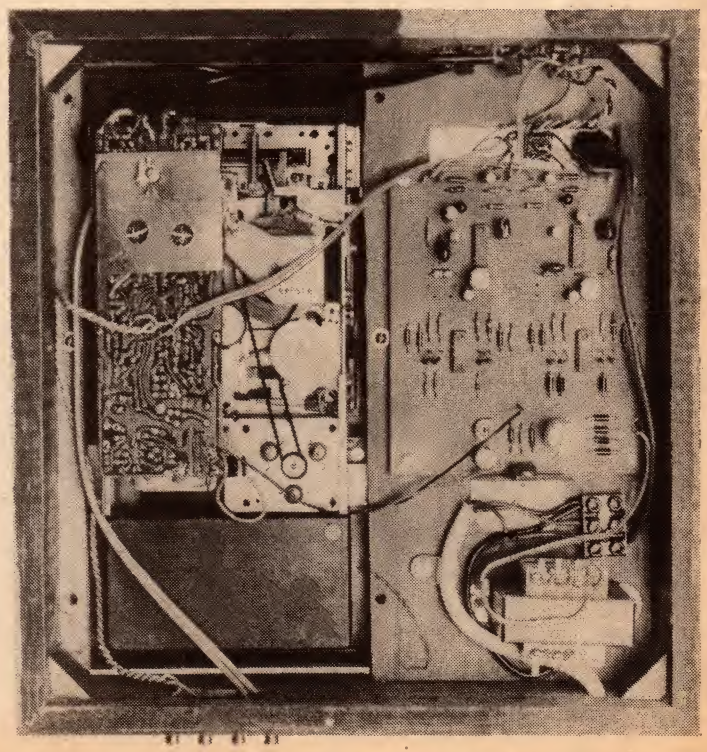
The output of the headphone amplifier is also fed to the LED indicator stages. This part of the circuitry is identical to that described in the October 1977 issue of Electronics Australia under the title "Stereo Level Indicator". The circuit is quite economical both in parts count and current drain. A brief description of its operation follows.

Each of the four op-amps in the LM3900 packages is connected as an inverting amplifier and biased to provide a different quiescent output voltage. The four op-amps in each channel are connected so that their outputs are stacked (while their inputs are in parallel). The op-amps operate as current sources, with the one at the bottom of the stack (output pin 4) turning on first.

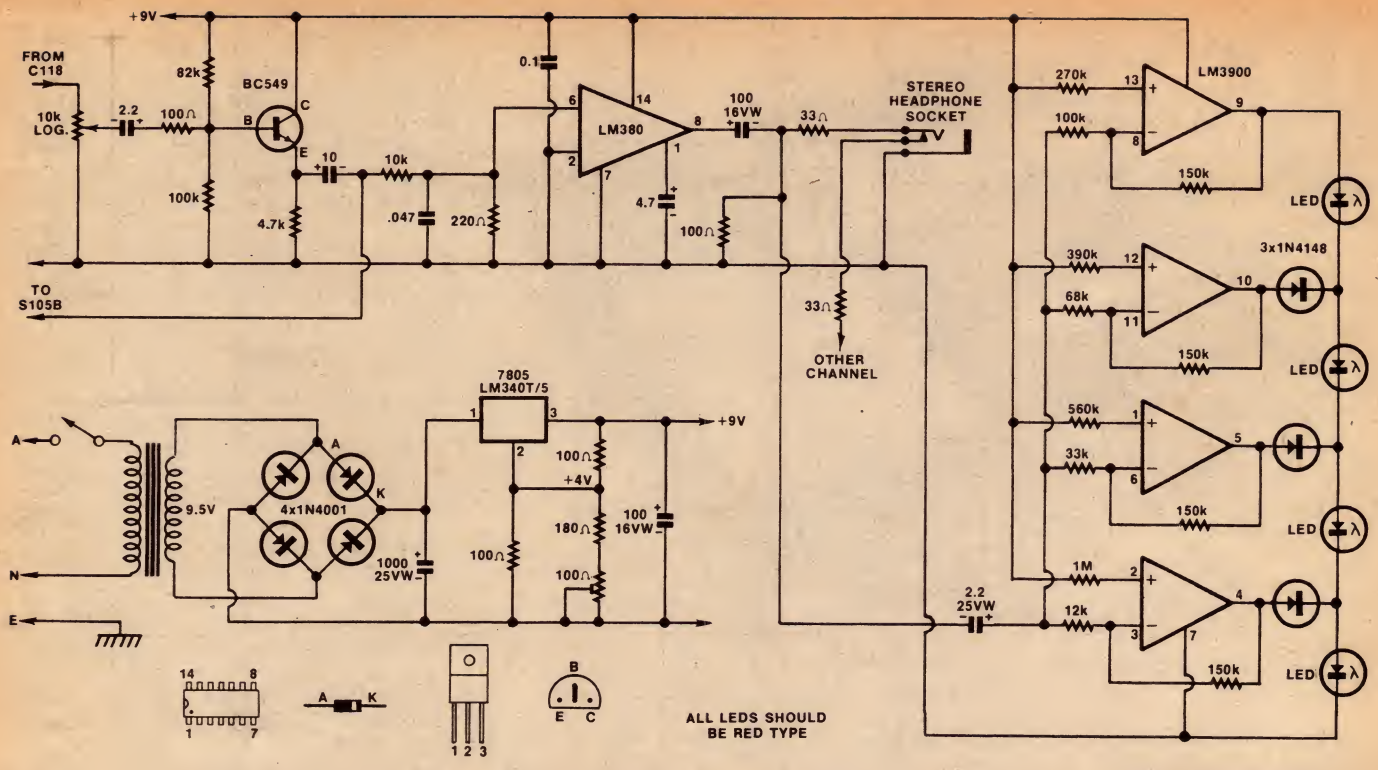
Each LED is changed from off to fully on for a signal level increase of about 7dB, so that the total range is about 30dB even though the lowest LED in the stack is marked -20dB on the control panel. These markings are really only approximate — as are the calibrations on most run-of-the-mill meters on tape recorders. All LEDs are alight when the signal is at maximum level.

The advantage of the LED indicator circuit is that it is more economical than a meter and its drive circuitry. It also shows up short transients better and requires no illumination or special mounting hardware.

Readers may have noted that we could have connected the LED in-



A view inside the completed cassette deck. Wiring to the LEDs comes off the back of the adaptor PC board.



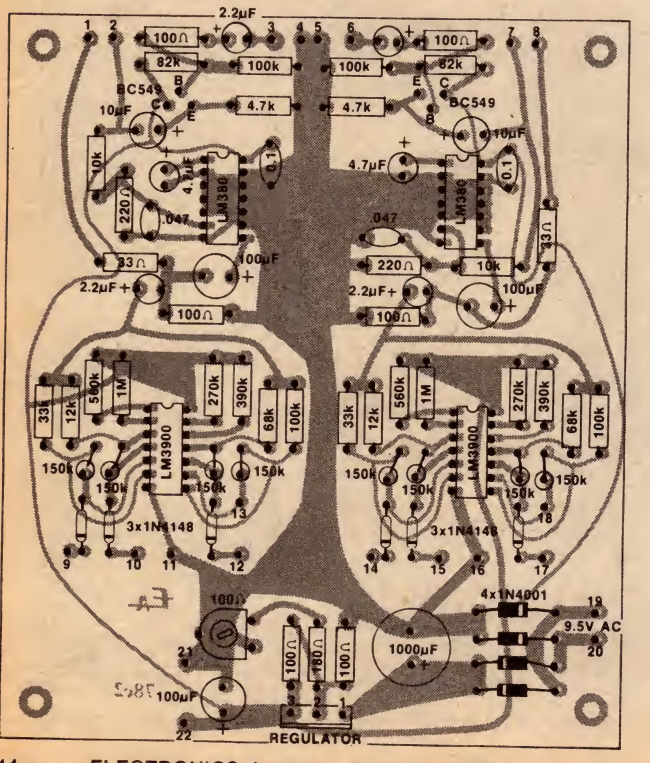
PLAYMASTER CASSETTE ADAPTOR
(FOR YOCOM 1000)

1/RA/-

dicator circuitry to the output of the emitter follower rather than to the output of the headphone amplifier. We took the latter course to reduce loading on the emitter follower and to avoid another problem — residual 60kHz bias at the output of the Yocom recording amplifier. Normally this is adjusted during manufacture to a low level with the aid of the bias trap coil YMH-20.

Even so, the residual bias was not low enough to avoid lighting up the bottom LED in the indicator circuitry. This was avoided by adding the .047uF capacitor at the input of the headphone amplifier. This rolls off the response above 15kHz.

The regulated 9V power supply is based on a 5V regulator IC, type 7805 or LM340T-5. The regulator circuit has a cost on a par with a discrete regulator circuit although it has the advantage of low ripple output and short circuit protection. The output voltage is adjustable over a small range to allow precise setting to 9V. This is necessary because the LED indicator circuitry is critical in this regard.



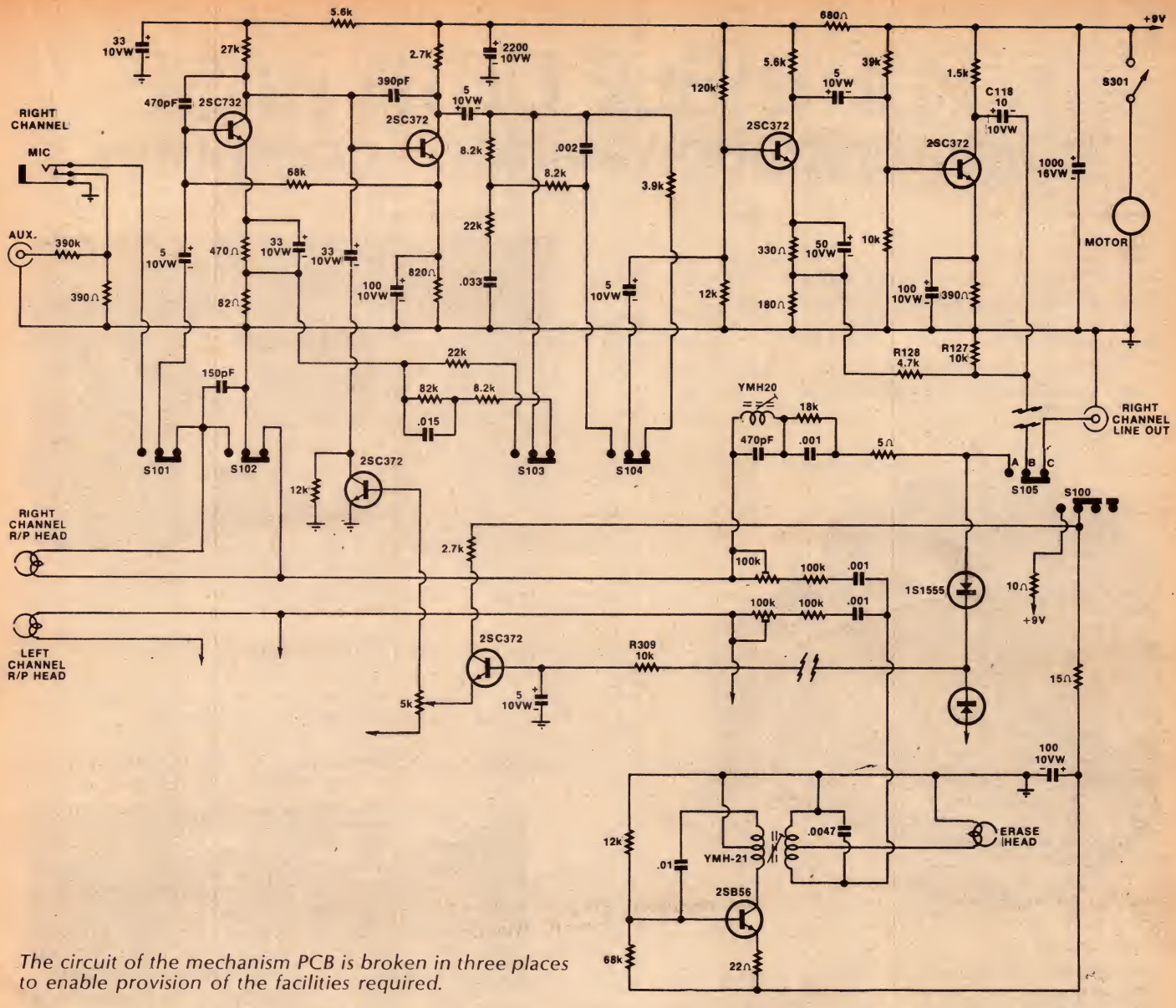
The component overlay pattern shows the PC board as viewed from the component side.

Construction of the deck presents some challenges. We hope that kit suppliers are able to make available a plinth of timber or metal at reasonable cost. Ours was made of solid timber but we assume that kit versions would be made of particle board covered with simulated wood veneer.

The cassette mechanism is secured to the underside of the plinth with the aid of six 3mm screws. Buyers should endeavour to obtain these screws when they purchase the deck. We cheated by re-tapping the mounting bushes in the plastic escutcheon to suit ⅛-inch Whitworth screws. You can do the same if you have an ⅛-inch Whitworth plug tap and wrench. Otherwise, make sure you obtain metric screws of suitable length.

We did not employ a chassis, for convenience and economy. The transformer, adaptor PCB and other hardware are screwed direct to the underside of the timber plinth using wood screws or self-tapping screws.

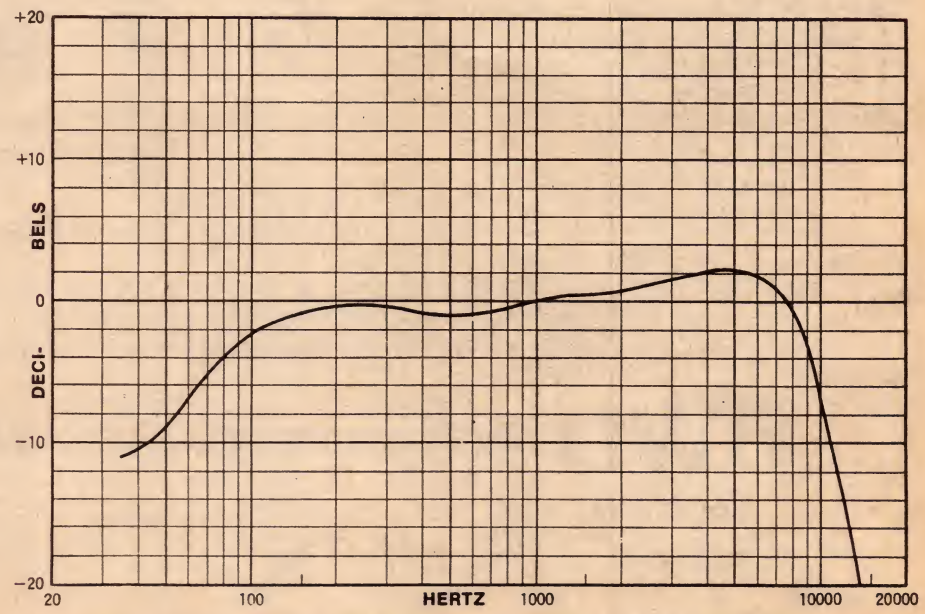
Two types of transformer are recommended, the A&R 2155 and the Dick Smith equivalent, DSE 2155. Other types have not been tried and may not be suitable because of high hum leakage.



The circuit of the mechanism PCB is broken in three places to enable provision of the facilities required.

SPECIFICATIONS

Tape speed: 4.75cm/sec
Wow & Flutter: 0.25% (RMS)
C60 rewind time: within 90 seconds
Motor: 9V DC with inbuilt solid-state speed control.
Heads: 1 half-track erase; 1 stereo ¼ track record/playback.
Frequency response: Record/playback response at -20VU is 100Hz to 9kHz within ±3dB (see graph).
Signal/Noise ratio: 45dB.
Separation between channels: 50dB or better at 1kHz
Erase ratio: better than 43dB; typically 48dB
Bias frequency: 60kHz.
Sensitivity: Line inputs, 300mV into 390k for 0VU.
Mic inputs, 300uV; suitable for low impedance microphones
Output level: 1V at 0VU; average output 150mV.
Output impedance: Less than 100 ohms.
Harmonic distortion: 2%.



This shows a typical record/replay frequency response with a good quality tape at minus 20VU.

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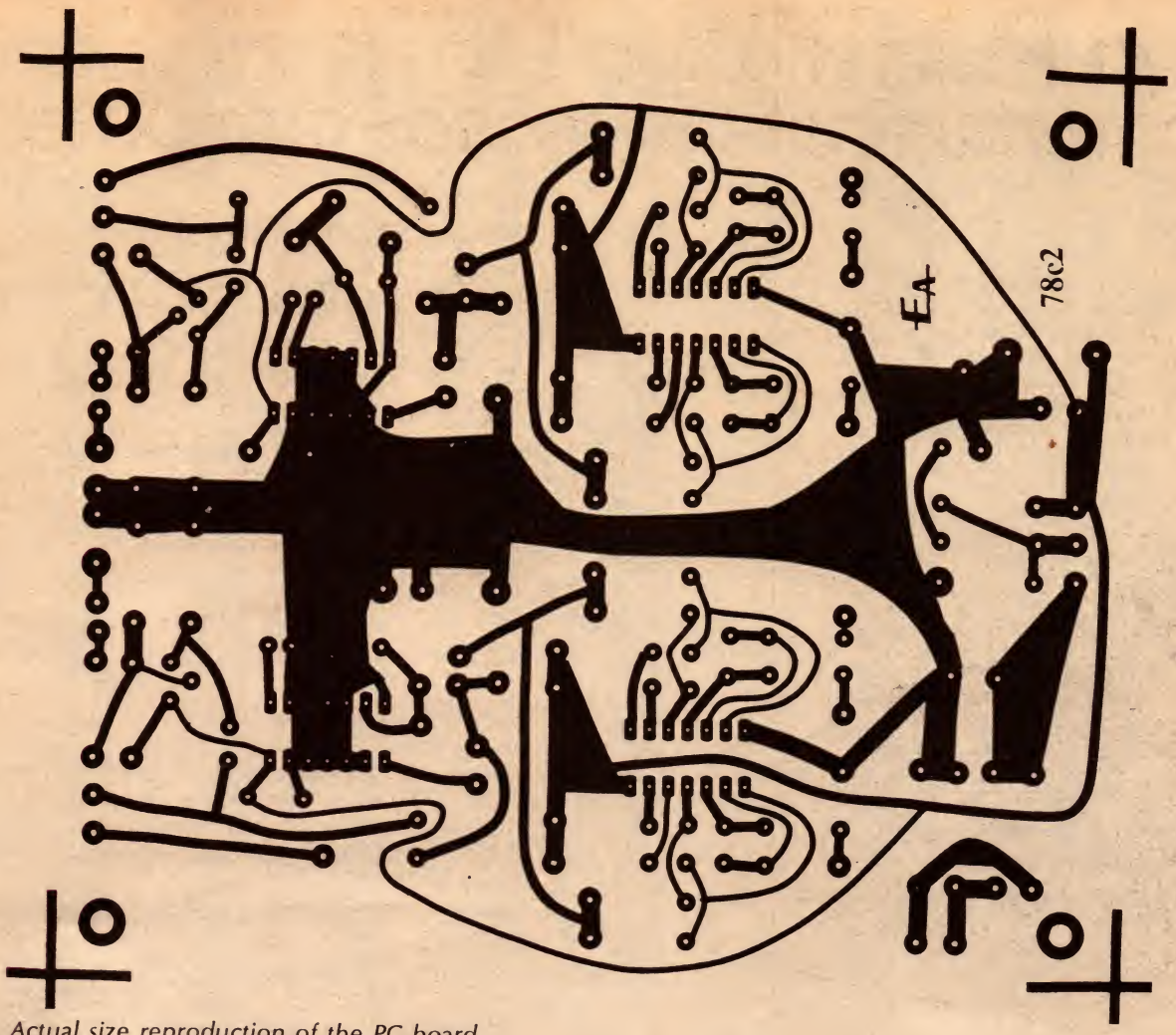


Actual size reproduction of the PC board.

PARTS LIST

HARDWARE

1 Yocom 1000 type 1 cassette mechanism with fitted plastic escutcheon, heads and push-buttons and six 3mm screws to suit plinth.
1 timber plinth with cutouts to suit mechanism and hardware
1 control panel, 110 x 150mm
1 power transformer with 9.5V tap on secondary, A&R 2155 or DSE 2155
1 4-way RCA socket panel
1 6.5mm stereo jack socket
2 6.5mm jack sockets with shorting contact
2 knobs to suit control panel
4 rubber feet
1 mains cord clamp
1 solder lug
1 insulating panel for microphone and headphone sockets
1 three-pin mains plug and three-core mains cord
2 x 10k (log) potentiometers
1 heatsink for regulator IC
8 red LEDs
300mm of 10-conductor rainbow cable
300mm of twin shielded cable (Figure-8)
500mm of shielded microphone cable (two conductors within a common shield).
1 three-way insulated terminal block
1 PC board, 77c2, 140 x 110mm
13 PCB pins

PC BOARD

SEMICONDUCTORS
2 BC549 low noise NPN transistors
2 LM380 14-pin IC quad operational amplifiers
2 LM3900 IC quad operational amplifiers
1 LM340T-5 or 7805 5V regulator IC
6 1N4148 small-signal diodes
4 1N4001 silicon rectifier diodes

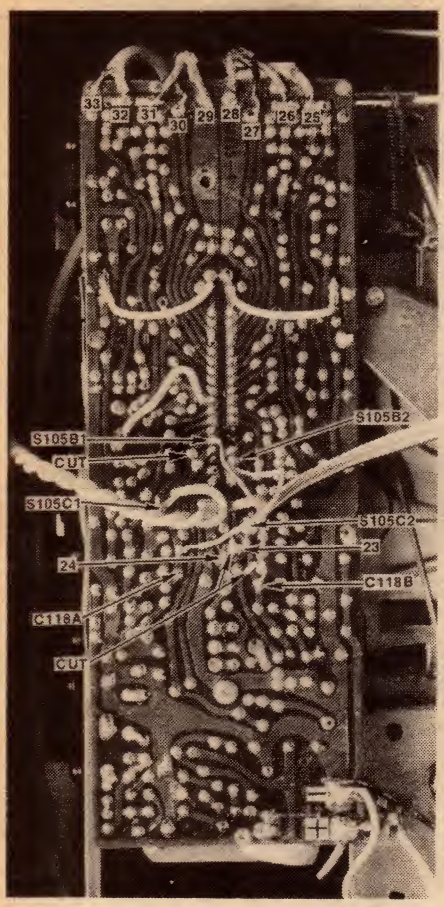
CAPACITORS
(preferably all PCB types)
1 1000uF/16VW electrolytic
3 100uF/16VW electrolytic
2 10uF/25VW electrolytic
2 4.7uF/25VW electrolytic
4 2.2uF/25VW electrolytic
2 0.1uF metallised polyester
2 .047uF metallised polyester

RESISTORS
(¼ or ½W, 5% tolerance)
2 x 1M, 2 x 560k, 2 x 390k, 2 x 270k, 8 x 150k, 4 x 100k, 2 x 82k, 2 x 68k, 2 x 33k, 2 x 12k, 2 x 10k, 2 x 4.7k, 2 x 220, 1 x 180, 4 x 100, 2 x 33 ohms.
1 x 100 ohm slider, miniature, horizontal mount.

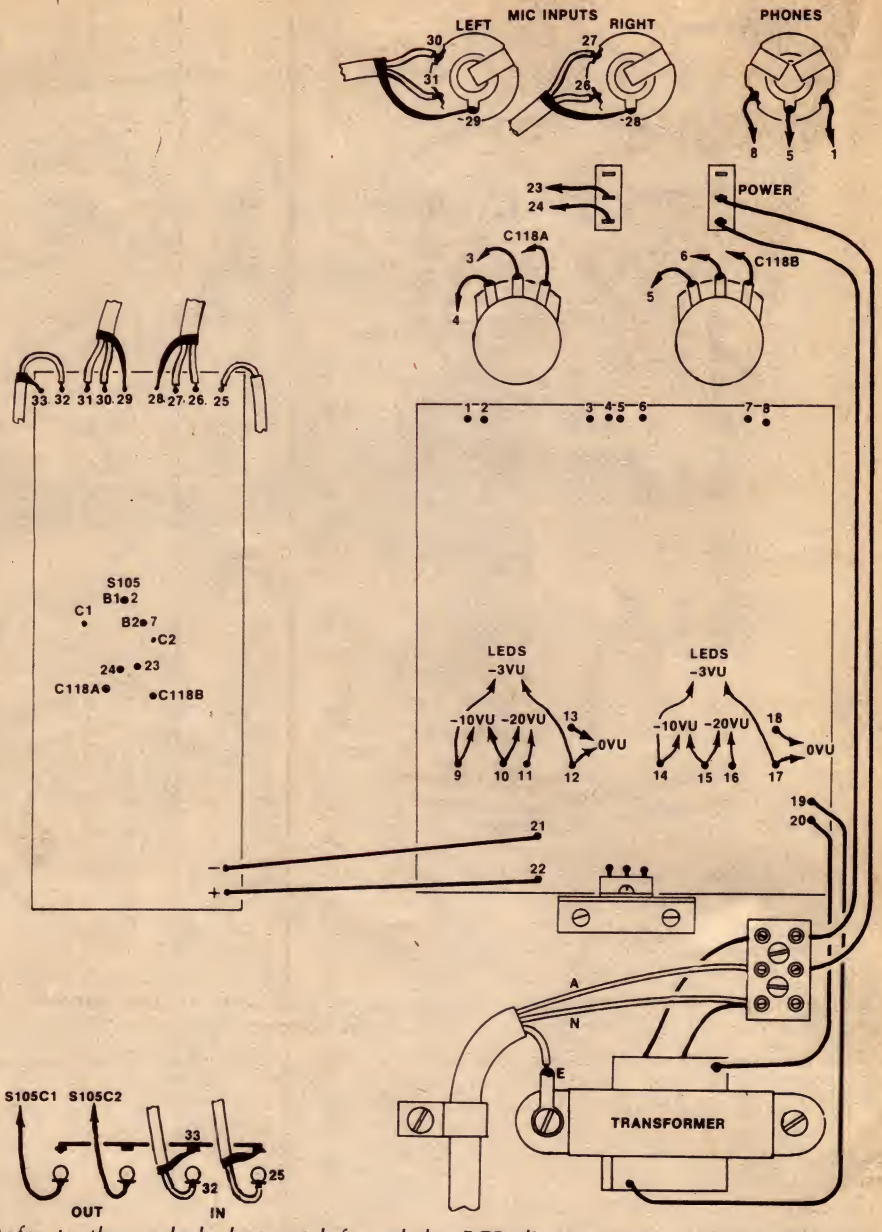
MISCELLANEOUS
Hookup wire, solder, screws, washers, spacers, insulating tape.

NOTE: A multimeter is required for this project. Components with lower ratings may be used provided their ratings are not exceeded. Components with higher ratings may also be used if physically compatible.

Playmaster stereo cassette deck . . .



This photo shows the three cuts to the copper pattern of the mechanism PCB and all the connection points.



Refer to the coded photo at left and the PCB diagram to complete the wiring.

The transformer should be mounted and oriented as shown in the photograph. It has to be kept as far away as possible from the playback head, to avoid hum induction. The mains cord is anchored with a cord clamp. Mains and neutral conductors are terminated to a three-way insulated terminal block, while the earth lead is soldered to a lug secured under one of the transformer mounting screws. The mains earth does not connect to any other metalwork in the system.

Assembly of the adaptor PCB is quite straightforward. Preferably the resistors in the LED indicator circuitry should have a tolerance of 5% or better.

Before mounting the adaptor PCB the control panel should be assembled and mounted. Again, we assume that kit suppliers will be able to oblige with a ready made panel. Ours was made as follows: The aluminium was marked up, cut and drilled. Then it was brushed with steel wool and a wire brush to obtain an even "scratch-grain" finish.

Then, without allowing fingers to touch and mark the panel, control legends were marked using Letraset. To protect the Letraset and surface finish, we applied a sheet of adhesive clear plastic. This is available from most newsagents and stationery supply stores and is normally used for protecting text and exercise books.

The LEDs are, or should be, a push-fit in the control panel and may be more permanently attached using an epoxy adhesive. Before they are secured they should be checked for brightness. This can be done by connecting four LEDs and a 150 ohm resistor in series across a nine-volt supply, which can be obtained with a temporary setup of the adaptor PCB. Some of the LEDs will be brighter than others. The brighter ones should be installed at the bottom of the array to give a more effective indication.

Now connect the wires from the control panel to the adaptor PCB, and mount the PCB with screws and spacers. Then attach the IC regulator to its heatsink. Our regulator heatsink was made of light gauge aluminium, 40 x 60mm, bent at right angles to form a 25mm foot.

At this stage apply power and set the power supply to 9V with the aid of a multimeter. If some of the LEDs still glimmer, tweak the present potentiometer to extinguish them.

Having checked the adaptor PCB you are now ready to make connections to the mechanism PCB. Our close up photo of the PCB and the wiring diagram should act as a guide. Do not connect the mechanism chassis to the mains earth. It must be connected to

(Continued on p115)

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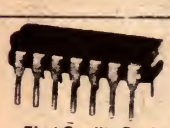

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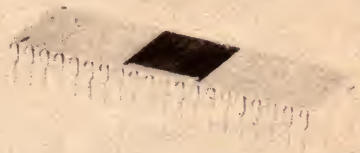
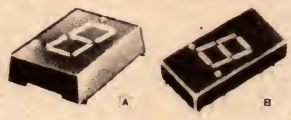


LEDs/Optoelectronics

Item	Cat. No.	Only
A. Solar Cell	276-115	1.59
B. Photocell	276-116	1.19
C. FPT 100	276-130	.99
C. Lg Red LED	276-041	1.39
D. Lg Cir LED	276-047	1.39
D. Med Red LED	276-026	1.39
D. Med Cir LED	276-040	1.39
D. Sm Red LED	276-042	1.39



Digital Displays

Digits	Size	Drive	Cat.No.	Only
A.1	0.6"	Anod	276-056	4.99
A.1	0.6"	Cath.	276-066	4.99
B.1	0.3"	Anod.	276-053	3.59
B.1	0.3"	Cath.	276-062	3.59
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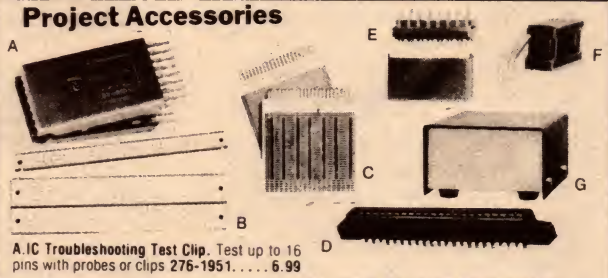

A. IC Troubleshooting Test Clip. Test up to 16 pins with probes or clips **276-1951**..... **6.99**

B. Experimenter Socket. 2x47 rows of 5 connected tie points **276-172**..... **14.95**

B. Bus Strip. 2x40 connected tie points Clips to socket above **276-173**..... **2.99**

C. Standard Edge-Card Board. 22-pin 1295 mounting holes **276-152**..... **3.99**

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C. 3-Voltage Source Edge-Card Board. 1368 mounting holes **276-153**..... **3.99**

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1N4004	276-1103	2/.89
1N4005	276-1104	2/.99
1N4735	276-561	2/1.29
1N4739	276-562	2/1.29
1N4742	276-563	2/1.29
1N4744	276-564	2/1.29
1N5401	276-1141	2/1.29
1N5402	276-1142	2/1.49
1N5403	276-1143	2/1.59
1N5404	276-1144	2/1.69
PTC205	276-1114	3/1.89

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SCR	200V 6A	276-1067	1.99
SCR	400V 6A	276-1020	1.99
Triac	200V 6A	276-1001	1.79
Triac	400V 6A	276-1000	1.99
BR	50PIV 1.4A	276-1151	1.29
BR	100PIV 1.4A	276-1152	1.49
BR	100V 4A	276-1171	1.99
BR	200V 4A	276-1172	2.29
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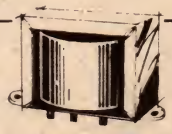

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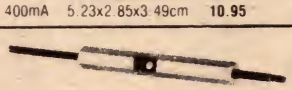
273-9013	Heavy Duty	18CT	4A	10.16x5.08x6.35cm	**14.95**
273-9520	Clock	18/5/5	400mA	5.23x2.85x3.49cm	**10.95**

IC Socket Wrapping Tool



For making superior, precision connections—without soldering. Wraps, unwraps, and strips 30-gauge wire. Modified wrap for extra security. No bits, sleeves or special skills needed. Balanced 11.43cm (4½") long. All-metal. **276-1570** **7.95**
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Versatile PCB can be used for active crossovers

Active filter unit

If you are interested in active crossovers and related subjects, this article should interest you. In it, the author describes the design and construction of a third-order Butterworth filter based on commonly available op amps.

by DAVID EDWARDS

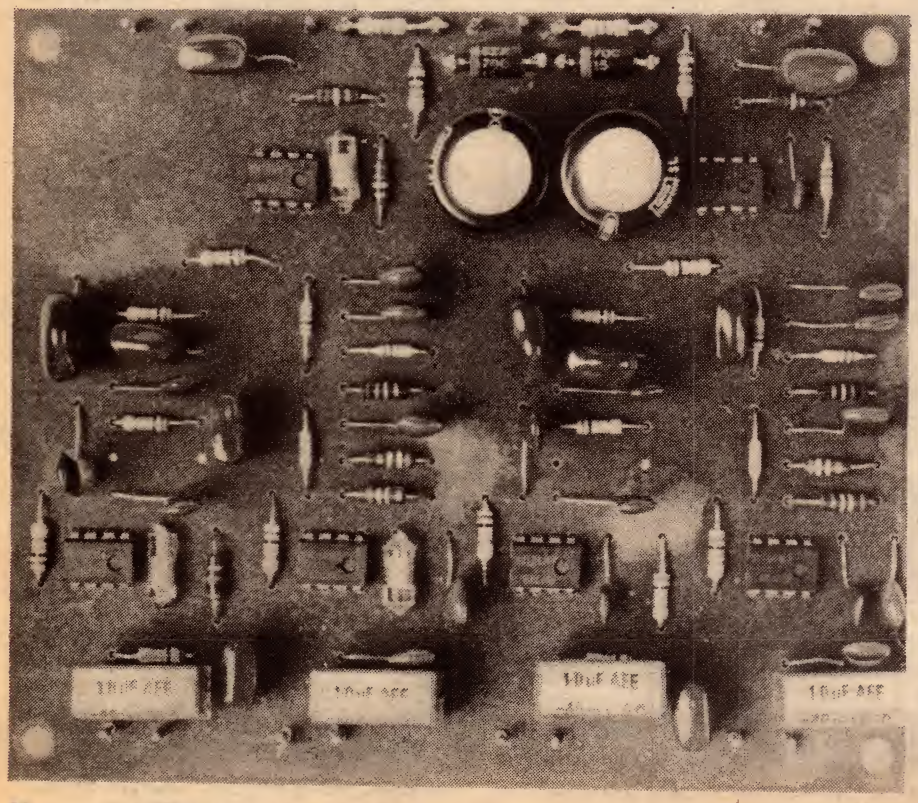
The most common method of amplifying the output of a preamplifier into the large signal required to drive a loudspeaker is to use a single power amplifier having a flat frequency response over the audio spectrum. Such amplifiers have evolved to the state of being almost perfect, adding very little distortion to the signal being amplified.

Very few satisfactory designs have been developed, however, for single speaker drive units which will cover the complete audio spectrum. This has meant that several drivers, each handling a portion of the audio spectrum, are required to construct a wide range loudspeaker system.

An immediate corollary of this is that the audio spectrum must be divided into suitable portions, so that each driver receives only signals within its range. Signals outside the required range must usually be attenuated, in order to avoid nonlinearities due to mechanical resonances and cone breakup.

The conventional way of doing this is to use passive crossover networks, which take the amplifier output and split it up (frequency wise) in the desired manner. In order to achieve the required cutoff rates, and to ensure that losses are kept to a minimum, large non-polarised capacitors and low resistance inductors are required.

Unfortunately, such components are expensive, and to design and construct suitable crossovers requires a good deal of experience.



In this view of the completed board, the power supply components are at the top, while the filter circuits are at the bottom.

An alternative procedure is to divide the spectrum before the main power amplifier, and then to use separate power amplifiers for each driver. Since the splitting is being performed at low signal levels, active filter networks, requiring only cheap (relative) components can be used.

There is a tradeoff, of course, in that more power amplifiers are required, although this may be partially offset by the saving in crossover components. However audible advantages can accrue from the use of separate amplifiers.

The main advantage is that intermodulation distortion in the amplifiers is reduced, because each amplifier is only called upon to amplify a portion of the audio spectrum.

The individual drive units may also have improved responses, because they are driven directly from amplifier outputs, and hence from low source impedances. Conventional crossover networks tend to degrade the damping factor, especially with regard to bass drivers and in the vicinity of the crossover frequencies.

The designer's task is considerably eased also, as it is much easier to alter and experiment with the parameters of an active filter than it is with those of passive filters. In addition, the parameters of active filters can be more easily controlled, and sharper cutoffs can usually be provided, as well as compensation for driver units with different sensitivities.

The impetus for the design presented in this article came from the author's desire to improve his own stereo system. The idea was to provide a seperate bass enclosure from that housing the mid-range and treble units.

After much thought and discussion, it was decided to cross over to the bass

driver at 300Hz, using an active crossover. The idea of combining the two bass signals from a stereo amplifier to form a mono signal, and then using a single amplifier, was abandoned because it seemed easier to build a 25W stereo amplifier (the Twin Twenty Five) than one 50W amplifier.

The next design consideration was the type of active filter to be used. Ideally, a constant voltage design, in which the vector sum of the outputs is equal to the inputs is the best choice, with a second requirement being that the design should be constant power (i.e., no peaks or dips in the overall passband).

A first-order Butterworth filter satisfies both these requirements, but has cutoff slopes of only 6dB per octave. Higher-order Butterworth filters satisfy the latter requirement, but are not constant voltage designs, although they have quite sharp rolloffs.

Constant voltage designs can be realised using the subtractive method, in which say a high pass function is achieved by subtracting the output of a low pass filter from its own input. But these designs are not of constant power, and tend to have unequal rolloff rates.

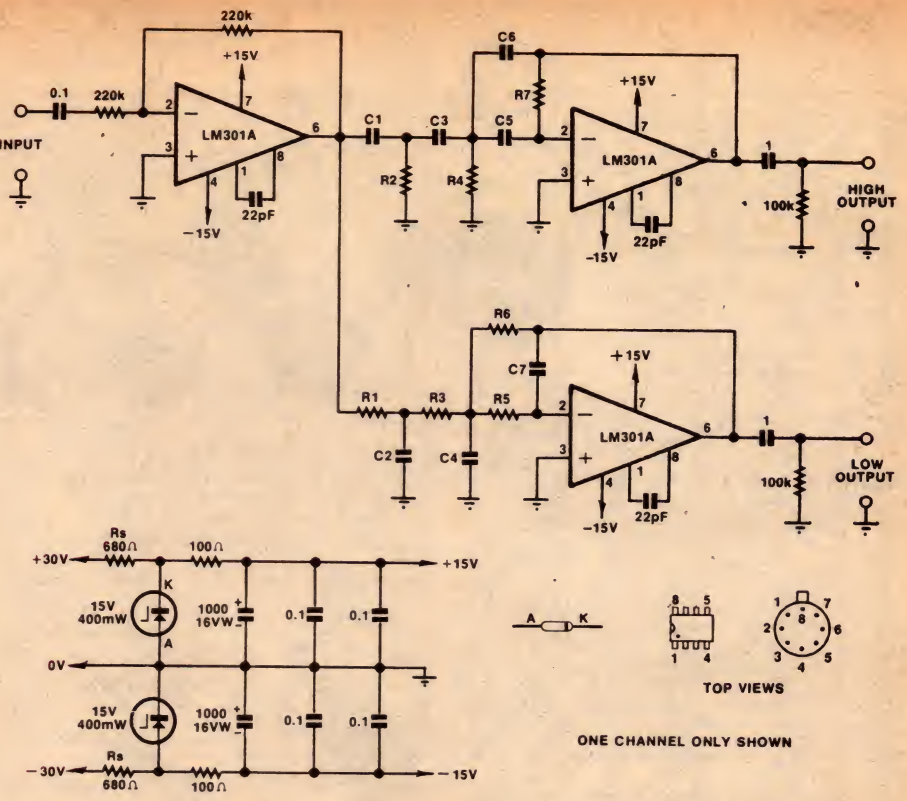
Having just deduced that no filter shape or generation method is completely satisfactory, it was necessary to find the least of the various "evils". In order to prevent directionality information from being produced by the bass driver, we required a sharp cutoff filter. Second-order Butterworth designs were rejected on the grounds that they produce severe phase shifting at frequencies near the crossover.

Third-order Butterworth designs, however, are much more acceptable. While there are phase shifts at the crossover frequency, the rate of phase change of the resultant signal is gradual, and this reduces the audibility of the change. In addition, since it was intended to have the bass units physically separate from the midrange and treble units, this phase change would not be as noticeable, due to the effects of room reverberation.

While the basic design of the crossover described is intended for the purpose outlined above, I believe it will be suitable for use at higher frequencies, with driver units in close proximity, where rapid attenuation in the stop band is required. Such cases arise for example, where a tweeter resonance has to be suppressed, while still maintaining operation close to the resonance.

So the information contained in this article will enable you to design and build third-order high and low pass Butterworth filters with crossovers at any desired frequency in the audio range.

Turning now to the circuit diagram, we can discuss the way in which the design has been implemented. LM301A type IC operational amplifiers have been used as the basic circuit gain element. 22pF compensation capacitors have been specified, to give a compromise between slew rate (which determines high level high frequency response) and stability.



3RD ORDER BUTTERWORTH ACTIVE FILTER 1/F/-

This circuit diagram shows only the power supply components and the components required to implement two of the four filters required for a stereo unit.

Plus and minus 15V supply rails are provided to ensure adequate overload margin, compared to the nominal signal level of 1V RMS. The noise performance of the op amps is such that a signal to noise ratio in excess of 65dB with respect to 1V RMS can be obtained, and a total dynamic range of about 85dB.

A unity gain inverting buffer is provided at the input, to ensure an adequate low impedance drive to the following filter circuits, and to provide overall non-inverting response (the filter circuits alone have inverting characteristics).

An input capacitor is provided, and the input impedance is 220k, as set by the input resistor. Two filters are driven from each buffer, one connected as a high pass and one as a low pass. Each filter utilises a single op amp.

A 1uF output coupling capacitor is provided for each filter. With the recommended 10k (minimum) load, this gives a -3dB point of 20Hz and minimises the effects of low frequency noise produced in the input circuits of the op amps. If higher load impedances are provided, these capacitors should be reduced in value, giving the same 20Hz rolloff point.

Zener diodes are provided to regulate the supply rails, with 100 ohm/1000uF combinations used to reduce ripple even further. Total current drain is approximately 20 mA per side. By varying the input dropping resistors, it is possible to operate the unit over a wide range of input supply voltages.

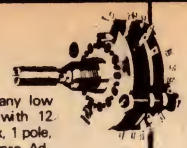
In order to aid in calculating the required values for different filters, we have provided a table of most likely required values, as well as details of the actual calculations. If you wish to use one of the crossover frequencies listed in the table, simply use the values tabulated with the desired frequency.

The columns labelled "pref" show the preferred value components required to be connected in parallel to obtain close approximations to the calculated values.

To see how the table was derived, we suggest you work through an example, using the method given below. This method will also be applicable to those who require crossovers at non-tabulated frequencies.

The first step is to choose the appropriate crossover frequency, fo. Then select R1 =10k, to set the input impedance of the filter at 20k. Next, calculateC1 = 1/(2.pi.fo.20000). Round the result of this calculation off to the

Switch Kit



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Bridge Rectifiers

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VM08 50V 1A **70c**
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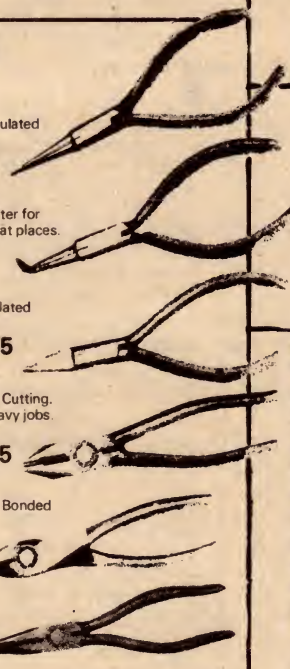
Assorted colours, 1 m lengths.

	1-9
.5 mm	22c
1 mm	24c
1½ mm	24c
2 mm	26c
4 mm	36c
5 mm	44c
6 mm	46c
8 mm	56c
10 mm	72c

Bargain Packet
10 mixed
$1.50

Tools



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4" Long Nose. Insulated handle.
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6½" Long Nose Pliers. Vinyl handles.
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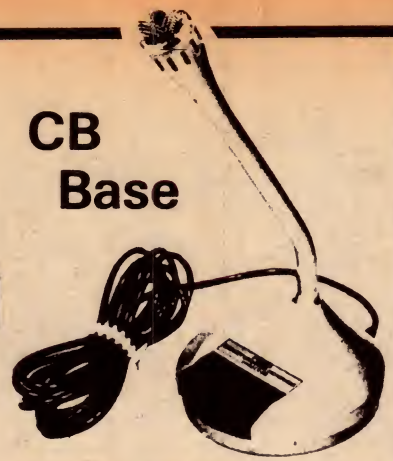
Resistors

Cracked carbon

	1-9	10-99	100 mixed
.125 watt 2.2 ohm-2.2 meg	4	3	2
.25 watt 2.2 ohm-10 meg.	4	3	2
.5 watt 2.2 ohm-10 meg.	5	4	3
1 watt 2.2 ohm-2.2 meg.	6	5	4

CB Base



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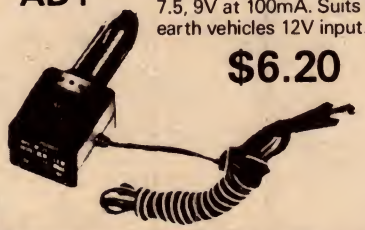
AD1



Auto DC to DC. Delivers 6, 7.5, 9V at 100mA. Suits neg. earth vehicles 12V input.

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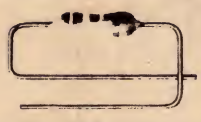
Metal Oxide



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1-9 **13c** 10 up **10c**

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T22 Miniature Terminal Posts. Red, Black. Height 32 mm. Dia. 21 mm

35c 30c

Calculator Keyboard

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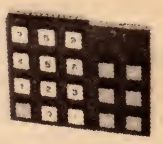

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Knife Switch

SW14 Knife switch DPDT. Ideal for TV aerial switching, etc.

1-9 **55c** 10 up **45c**

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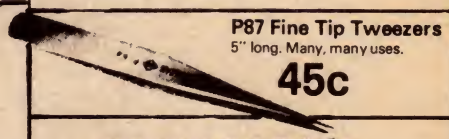

45c

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	1-9	10 up
10-lug	50c	40c
20-lug	90c	75c

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50 ohm, 100 ohm, 500 ohm, 1K, 5K, 10K, 25K ohm, 50K, 100K, 500K, 2 meg

1-9 **90c**
10 up **80c**

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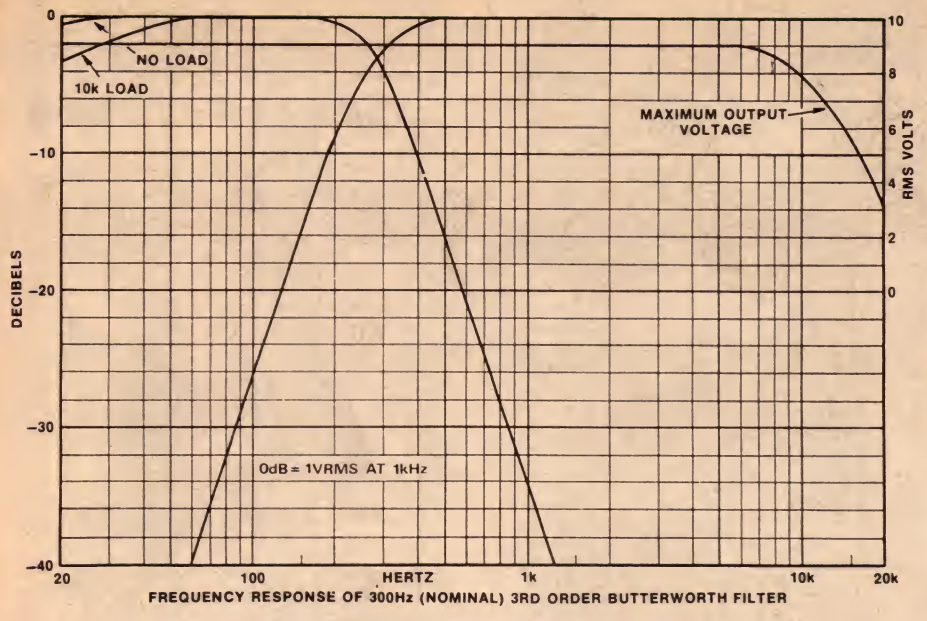
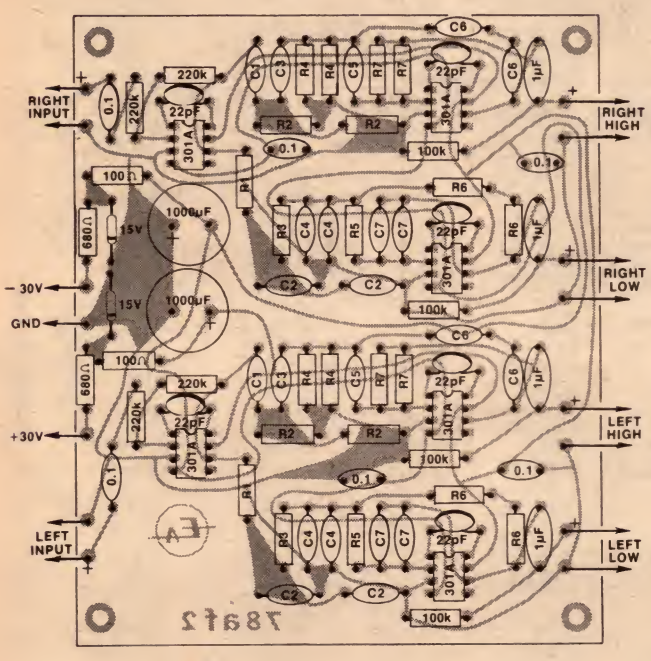


FREQUENCY RESPONSE OF 300Hz (NOMINAL) 3RD ORDER BUTTERWORTH FILTER



ABOVE LEFT: The response of the prototype is shown in this graph, as well as the maximum output voltage.

LEFT: Use this overlay diagram as a guide when mounting the components on the printed circuit board.

RIGHT: This table gives preferred values of components required to construct filters with a variety of crossover frequencies.

Fo(Hz)	C1 (uf)		Req (ohms)	Ceq (uf)	R2 (k)		R4 (k)		R7 (k)		C2 (uf)		C4 (uf)		C7 (uf)	
	calc	pref			calc	pref	calc	pref	calc	pref	calc	pref	calc	pref	calc	pref
100	.0796	.082	19409	.159	7.89	8.2//220	9.20	10//120	100.5	100	.390	.39	.335	.33	.0307	.027//.0039
300	.0267	.027	19649	.0531	8.00	10//39	9.31	10//150	100.7	100	.130	.12//.01	.112	.1//.012	.0102	.01
500	.0159	.015	21221	.0318	8.64	10//68	10.06	10	109.9	220//220	.0781	.039//.039	.067	.068	.00614	.0056//.00056
700	.0114	.010	22736	.0227	9.25	10//120	10.78	18//27	117.7	120	.0557	.056	.0479	.015//.033	.00438	.0039//.00047
1000	.00796	.0082	19409	.0159	7.89	8.2//220	9.20	10//120	100.5	100	.0390	.039	.0335	.033	.00307	.0027//.00039
2000	.00398	.0039	20404	.00796	8.30	12//27	9.67	10//270	105.6	120//820	.0195	.018//.0015	.0168	.015//.0018	.00154	.0015//.000039
4000	.00199	.0022	18086	.00398	7.36	10//27	8.57	10//68	93.6	100//1500	.00977	.01	.00839	.0082//.00018	.000768	.00068//.000082

nearest preferred value.

R3, R5 and R6/2 are all made equal to R1, while C3, C5 and C6/2 are all made equal to C1. The passband gains are determined by R6, R1 and R3, and by C6, C1 and C3, so in order to set the gain at unity, R6 and C6 are formed by series-connected units.

The next stage in the procedure is to calculate Req = 1/(2.pi.fo.C1), and Ceq = 1/(2.pi.fo.R1). These values are then used to determine the remaining unknown values, using the formulae listed below:

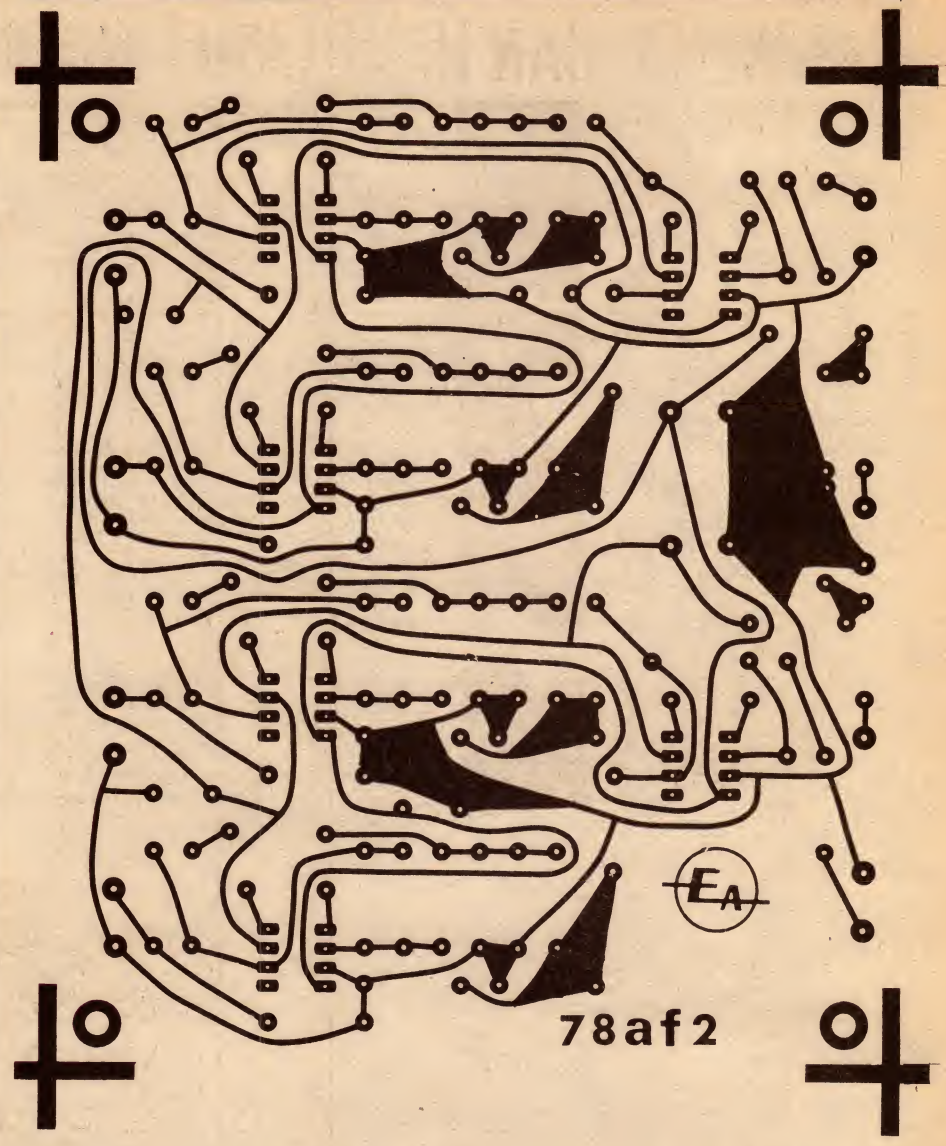
R2 = 0.407Req; R4 = 0.474Req; R7 = 5.177Req

C2 = 2.455Ceq; C4 = 2.109Ceq; C7 = 0.193Ceq

These last six values will have non-standard values, so in order to achieve optimium cutoff slopes and matching of the crossover frequencies, it will be necessary to use two standard value components to approximate to the calculated value. The combination charts represented in the June 1975 issue, and again in the 1976/1977 Yearbook will be found to be invaluable in this respect.

In order to simplify the design of the printed circuit board, we only provided for parallel components, so this must

Active filter unit



This full sized reproduction of the PCB pattern can be used to make your own circuit boards with. It can be used direct or traced. Commercial boards will be available from the usual sources in due course.

be born in mind when selecting values. We found that 5% or 10% components were satisfactory in practical use, although theoretically 1% components should be used for optimum results.

We have designed a small printed circuit board, coded 7af2, and measuring 110 x130mm. This has provision for two channels of the circuit shown in the diagram, and utilises six op-amps in all. Assembly of the components onto the board should be straightforward, using the component overlay diagram as a guide.

PCB pins are recommended for all external connections to the board; 15 will be required. Care is required when completing the external wiring to avoid earth loops, as these will almost certainly increase the hum level.

The performance of the prototype is shown in the accompanying specification table and frequency response graph. The high frequency rolloff in the maximum output voltage curve is due to slew rate limiting. In practice, of course, high frequency high level signals are fairly rare, and this does not cause, any audible deterioration in typical signals.

In conclusion, we would like to point out that the unit can be used as a signal processing unit, as well as an active crossover network. If all filters were made high pass, with rolloffs at say 7kHz and 15kHz, the board could be used as a switched scratch and hiss filter. Note, however, that it cannot be used as a rumble filter, because such a filter should be at the input of a system and the inherent noise of this present design is too high to allow it to be inserted in the signal chain before the preamplifier.

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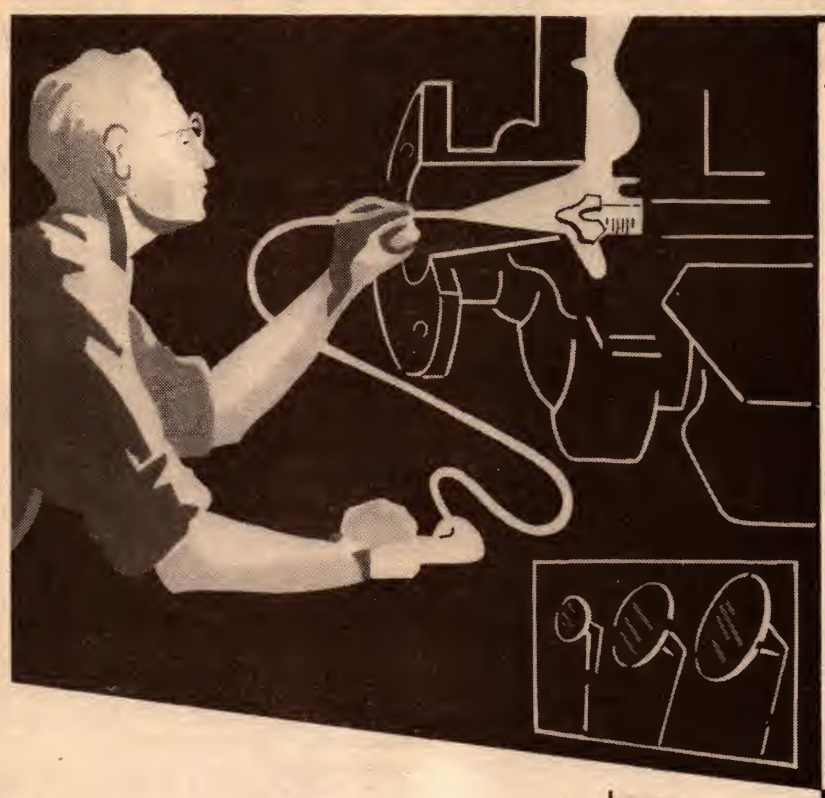

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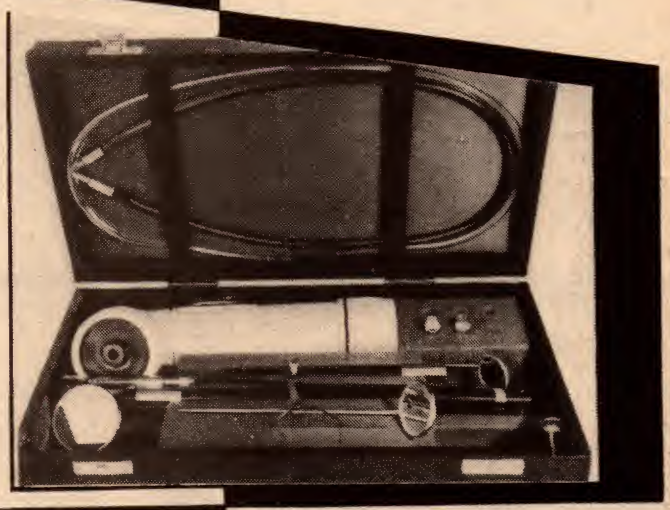

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Teach yourself electronics with

Heathkit Individual Learning Programs

We get many requests from readers for information on home training courses in electronics which the individual can study at his own leisure and pace. One possible solution, and one which we can thoroughly recommend, is the Heathkit Individual Learning Program (ILP) system.

by GREG SWAIN

Part of what Heath refers to as its "Continuing Education Series", the ILP system consists of a series of self-instructional electronics programs designed to allow convenient home study. Included in this series is an "Electronics Fundamentals" course, made up of four basic programs and a separate "Experimenter/Trainer" kit.

The four learning programs are in graded order, each program a prerequisite for the next. They are as follows:

- Part 1: DC Electroncs;
- Part 2: AC Electronics;
- Part 3: Semiconductor Devices; and
- Part 4: Electronic Circuits and Applications.

Of course, these programs may be bought either separately or together. For example, the student who feels he already has sufficient grounding in AC and DC circuit theory may choose to buy only Parts 3 and 4 of the course — Semiconductor Devices and Electronic Circuits and Applications.

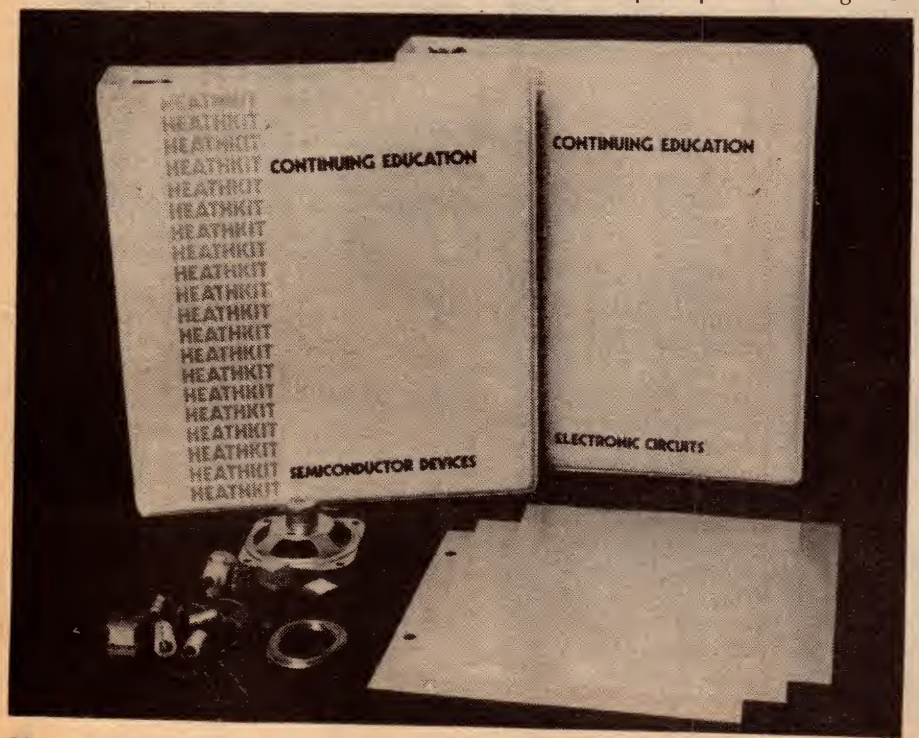
Each individual program is divided up into units, each unit dealing with a specific topic. An idea of the course content can perhaps best be gained from a listing of these various units.

In Part 1 the various subject units are Electron Theory, Voltage, Resistance, Ohm's Law, Magnetism, Electrical Measurements, Network Theorems, and Inductance and Capacitance; Part 2 — AC Fundamentals, AC Measurements, Capacitive Circuits, Inductive Circuits, Transformers, and Tuned Circuits; Part 3 — Fundamentals, Diodes, Zener Diodes, Special Diodes, Bipolar Transistor Operation, Bipolar Characteristics, FET's Thyristors, ICs, and Optoelectronic Devices; Part 4 — Basic Amplifiers, Typical Amplifiers, Operational Amplifiers, Power Supplies, Oscillators, Pulse Circuits, and Modulation.

The ILP system has been designed to teach the student thoroughly and efficiently. Each individual learning program is made up of a large folder of printed material, reinforced by gramophone records and periodic reviews of pertinent topics.

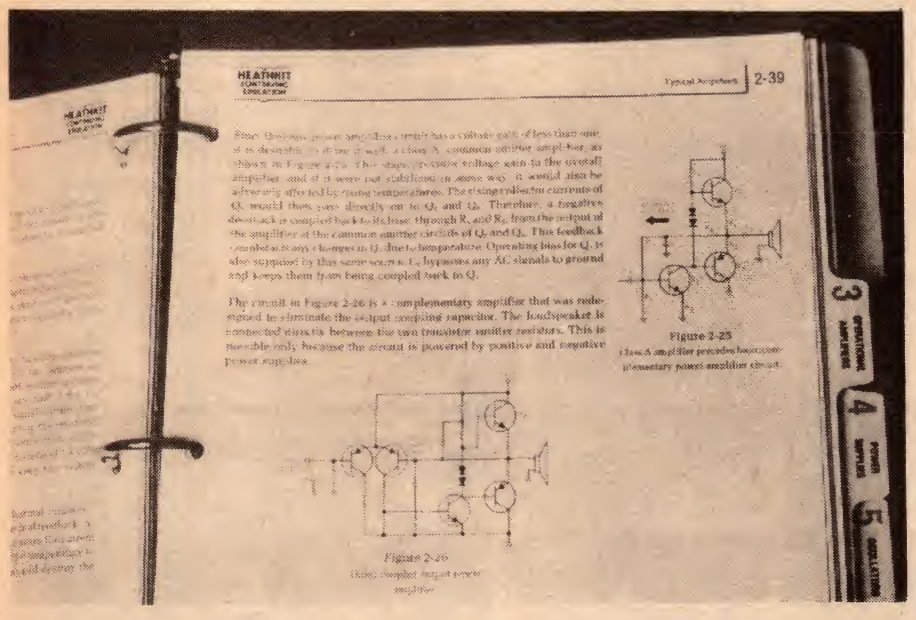
Further program reinforcement is provided by the experimental material provided with each learning program. This material includes a range of electronic components which the student assembles into a variety of circuits, to get actual "hands on" experience.

The experimental work is designed to be carried out on the Experimenter/Trainer, assembled by the student at the beginning of the course. Facilities provided by the



Parts 1 & 3 of the Heathkit Independent Learning Program system. Gramophone records and electronic components reinforce the learning process.

Part of the Experimenter/Trainer kit is shown above, while below is a typical page from one of the instruction folders. The text is well written.



trainer include a solderless breadboarding socket, a 200Hz-20kHz sine and square wave signal generator, two 50Hz sine wave signal sources (15V and 30V), two variable and regulated power supplies for positive and negative voltages (1-15V DC), and two built-in linear potentiometers (1k and 100k). The power supplies are both short-circuit protected.

Although it is not absolutely necessary that the experiments be performed on the Experimenter/Trainer, it is still an excellent learning tool and a very worthwhile supplement to the learning programs. And, after you've completed the programs, the trainer can be used for breadboarding your own design projects.

Our overall impressions of the Heathkit Individual Learning Program system are very good. The course material is highly readable, and the student is led in a logical manner from one concept to the next. There is even an optional examination paper (multiple choice question type) which the student can fill in at the completion of each program and forward to the Heath Company for marking.

So the student who applies himself should certainly finish with a good knowledge of electronics. And if you want to go further, Heath offer a digital electronics learning program, and a recently introduced microprocessor learning program based on the Motorola 6800 chip. A digital Experimenter/Trainer kit is also offered as a complement to the digital electronics program.

The Heath Company is represented in Australia by Warburton Franki Pty Ltd, who have branches in all state capitals and in Wellington, NZ. Heathkit products are available from The Heath Centre, 220 Park Street, South Melbourne, Vic. 3205 (tel. 699 4999).

Bally Pinball machine uses a Motorola 6800 microprocessor

Amusement parlours are not often thought of as havens for high technology devices, but the recent introduction of video games has established a trend in this direction. The latest pinball machine from Bally uses a microprocessor — the Motorola 6800.

by LEO SIMPSON

The news of this development came from the Australian distributor for Bally pinball equipment, Amusement Machine Distributors Pty Ltd, of 19 Marsden Street, Camperdown. Naturally, they are very enthusiastic about the machine, to the point where they have set up an operator training course to enable technicians from all over Australia to become familiar with it.

Rising costs of service and the need to keep "down-time" to a minimum have made the microprocessor-based pinball machine a viable economic proposition. Pinball machines are basically very rugged devices, but they are subject to rigorous operating conditions. They experience severe vibrations, both from their own internal machinations and from the people playing them.

In addition, because the appeal of each machine is ephemeral, they have to be moved frequently to new locations. All this takes a considerable toll on reliability and so servicing is often required.

Servicing pinball machines can be a tedious and expensive business, because they are really electro-mechanical monstrosities. They have multitiudinous solenoids and other doodads all hooked together with a nightmarish wiring harness.

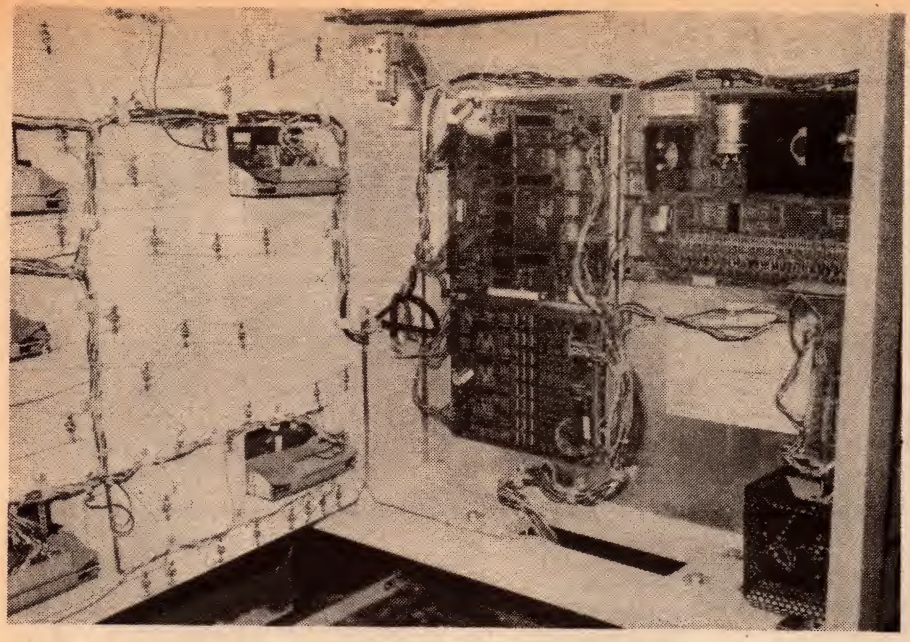
The microprocessor pinball machine still has umpteen solenoids and a complex harness. But the microprocessor performs self-diagnosis of all functions, so that most service operations will just be a simple matter of component changeover.

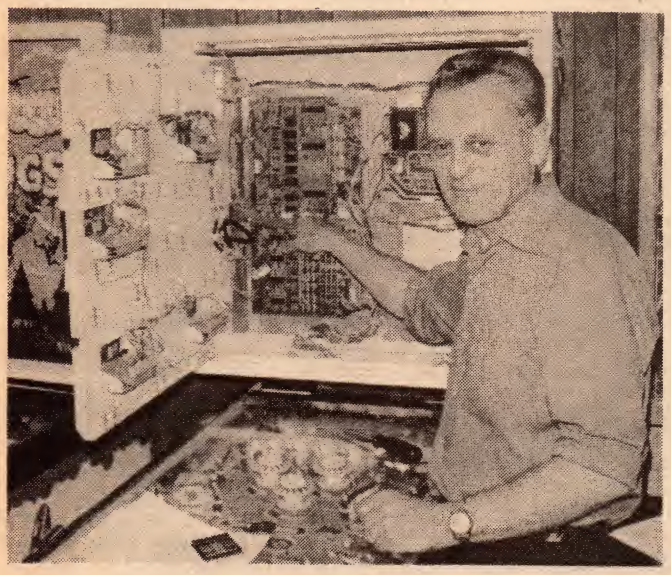
To look at, the new machine is little different from older units. It is just as gaudy and bedecked with coloured lights. The only external indication that it might have electronic intestines is the multiple array of gas-discharge digital readouts.

Further examination points up more differences, such as the fact that four persons can play and have their scores individually tallied and recorded. But apart from these relatively subtle scoring features, the affect of the microprocessor will not normally be apparent to the player. The main advantages accrue to the owner/operator.

For a start, the microprocessor and its associated memory chips keep a record of accounting functions for the operator: total number of games

Leo Ankus, of Amusement Machine Distributors Pty Ltd, demonstrates the new microprocessor-based pinball machine.





Above is a view inside the top compartment of the machine. Below, Leo Ankus points to the microprocessor PCB and its standby power supply which is provided by nickel-cadmium batteries.

played, total of free games and total of money in the cash box. These figures are available via the readouts at the push of a button in the slug rejector compartment. By assessing these figures the operator can decide to move the machine to a new location.

Nickel-cadmium batteries provide a standby power supply for those memory chips involved in the accounting functions.

After the operator has extracted the cash he can quickly run the machine through its diagnostic routines to check for any malfunctions. In the first routine the MPU checks itself and flashes a LED seven times to indicate that its operating correctly. In the second routine, all the lamps are checked.

In the third routine, all the digital readouts are checked, i.e., they are all cycled through 0 to 9.

All solenoids are checked in the fourth routine. Each group is checked in a separate step — thunk, whack, click, bong ... and so on. If one malfunctions, the routine stops at that particular step, which is indicated by one of the readouts. The final routine checks all switch contacts.

The point of these routines is that it could take the operator quite some time to identify these faults in a normal machine. Once the machine displays a fault the operator can consult the long list of symptoms in the manual to help pinpoint the malfunction.

For tracing more subtle faults, further diagnostic routines are available with a small module PCB. This mates with a socket on the microprocessor PCB and is mainly used for checking continuity of circuits.

By at least one account, the new Bally machine is a runaway success. Since its initial introduction in the latter half of 1977, the local distributors have sold around 500 units. At the going price of about $2000 each, you don't need a microprocessor to calculate total sales in the vicinity of one million dollars.

The Serviceman

Power supplies can be tricky

Although colour sets tend to dominate our thinking these days, there is still a significant amount of service work involving monochrome sets; particularly early solid state sets which are usually kept as a second set and are new enough to justify the cost of repairs.

Two jobs I had recently involved this type of set but were also notable because they both suffered from power supply problems and both power supplies employed rather tricky circuits.

The first set was a Kriesler model PT1 and the owner's complaint was that the picture would roll every few seconds. Superficially, one would expect such a complaint to involve the vertical oscillator stage, or even the sync separator. But when I switched the set on the first thing I noticed, even before it had time to roll, was a distinct hum pattern on the picture.

This put a different slant on things. Maybe there was a fault in the vertical or sync stages, but there was no point in looking for it while the hum problem remained. And there was a very good chance that, when the hum was removed, the rolling would stop also.

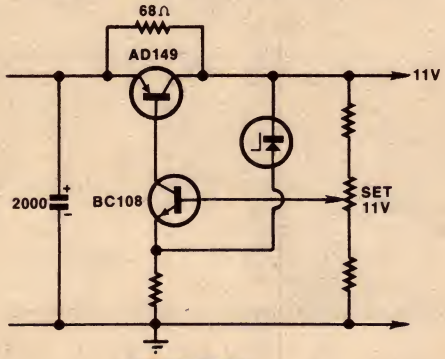
The main supply rail for the set runs at 11V, this being from a voltage regulator. The voltage regulator is a little unusual in some respects in that it uses a PNP type transistor as the series regulating element, rather than the more usual arrangement employing an NPN transistor as an emitter-follower.

Use of the PNP transistor means that its forward bias has to be derived from the regulated side of the system (i.e., the collector side) and this can lead to a "lock out" situation. In theory, at least, the regulator transistor cannot pass any current until it is supplied with forward bias, but there can be no forward bias available until it passes current!

In practice, some circuits probably depend on a certain amount of leakage to get things started, particularly where a germanium transistor is employed. The transistor in this case was a germanium type — an AD149 — but even so the designers had seen fit to connect a 68 ohm resistor between emitter and collector, just to be on the safe side.

The base of the AD149 is controlled by a BC108, the emitter voltage of which is pegged by a zener diode, and the base voltage set by a 1k trim pot which is used to set the 11V rail.

I started by checking the 11V rail, which turned out to be marginally high, I adjusted the 1k pot slightly to reduce it and noticed that this also seemed to reduce the hum bars slightly, though I couldn't be sure.



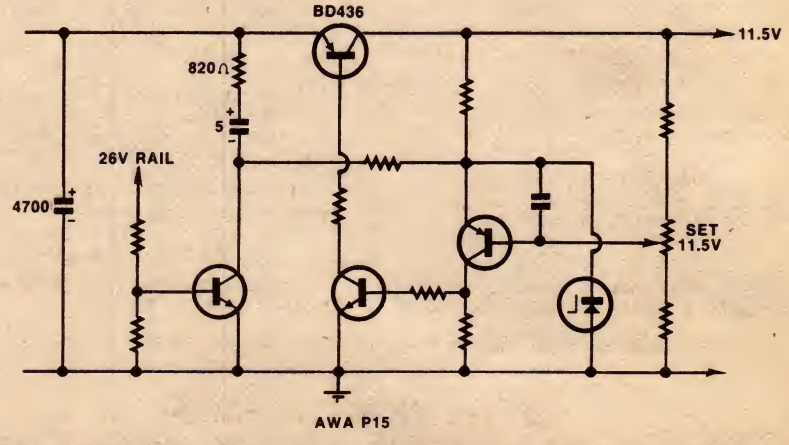
This circuit uses a 68 ohm resistor across the AD149 to ensure sufficient leakage current to "start" the system.

Next I checked the electrolytics in the power supply; a 2000uF across the rectifier and a couple of smaller ones in decoupling circuits following the regulator. I could find nothing wrong with any of them.

Remembering how the hum bars seemed to decrease when I reduced the rail voltage slightly, I went back to the 1k pot and tried reducing the voltage still further. Sure enough, the hum bars continued to weaken as I lowered the voltage until, at about 8V, they vanished — and the picture stopped rolling.

While I still had to find the precise nature of the fault, I had at least established two points. One was that, as I suspected, the rolling was due to the hum; the other was that the hum, in turn, was due to a failure in the regulator circuit. By their very nature, regulator circuits are very effective filters, since they tend to oppose any change in voltage, whether due to changes in line voltage or ripple from the rectifier. In fact, they replace older and more expensive filter components, like chokes.

A quick check around the circuit for faulty resistors and the like revealed



Simplified circuit of the P15 regulator. The starting circuit consists of the 820 ohm resistor and the 5uF capacitor, which provides a momentary alternative circuit to the emitter of the regulator amplifier.

nothing, suggesting that it was one or the other of the transistors. The AD149 was the easier one to get at, so I tried replacing it first, but this made no difference.

Replacing the BC108 wasn't so easy, but the effort was worthwhile. When I switched on the main rail came up to 9V and there was no sign of any hum bars. I took it up to 11V and everything worked fine. There were no hum bars and there was no rolling.

Fairly obviously, the BC108 was faulty, though the exact nature of the fault is a little obscure. But whatever it was it apparently could not maintain the regulating action at much above 8V.

The second set was an AWA P15. Its failure was more drastic; it had lost both picture and sound. Once again the regulator system employed a PNP transistor and once again it was designed to deliver 11V.

But there the similarity ended. It was not delivering any voltage, the transistor was a silicon type (BD436), and the circuit was a good deal more complex. For one thing it employed two transistors as the regulator amplifier and, for another, the starting mechanism appeared to be rather more refined than the simple 68 ohm shunt resistor.

While I have not been able to analyse the circuit in detail, it appears to employ a kind of "kick start" arrangement: an 820 ohm, 5uF resistor/capacitor network which, at switch-on, feeds a pulse into the regulator amplifier to get the system started.

It also appears that the circuit is designed to disable this starting system, once the regulator is working, by sensing the presence of voltage on the 26V rail, which is supplied from the EHT transformer. A possible reason is that, unless the capacitor is discharged after the starting cycle, the system may not start again after the next switch-off, switch-on cycle.

In fact I am not sure to what extent the ramifications of this circuit had anything to do with what I found but, inasmuch as this presented something of a puzzle, they may well be involved.

On previous occasions these symptoms in this set have been due to a shorted horizontal output transistor, so I checked this first. But I drew a blank this time, the transistor testing out OK.

Next I decided to check the BD436 regulator transistor, so I removed it from the set and checked it in the transistor tester. When it checked OK I assumed that the fault must be elsewhere, and spent some time checking the other transistors, resistors, and capacitors around this part of the circuit. Again I drew a blank.

Somewhat frustrated I considered the BD436 again and, to make sure I had checked it correctly, I connected a new one into the tester and compared the readings. For all practical purposes it read the same as the one I had removed but, on an impulse, I fitted the new one into the set.

Much to my surprise the set sprang into life and all voltages seemed to be normal. Had I disturbed a faulty joint in removing the BD436? I replaced the original but it simply wouldn't work, yet when I re-fitted the new one the set came alive again.

Why? I'm afraid that remains a mystery. All I know is that, according to colleagues to whom I related the story, regulator circuits employing PNP transistors are generally regarded as being "cranky". And, unfortunately, pressure of time often prevents a full investigation as to exactly why a certain component is critical; it is enough to get the set going and move on to the next job.

A low cost video display unit

Here is a new design for a low cost video display unit, capable of displaying data from a microcomputer on a standard TV receiver or monitor. It displays 16 lines of 32 characters and offers both flashing cursor and a destructive backspace facility. All timing is derived from a crystal oscillator, and no setting up is required.

by MICHAEL O'NEILL

Physics Department,
Newcastle University

This Video Display Unit (VDU) was designed primarily for the microprocessor system user, who requires a video terminal of minimum complexity to enable him to communicate with his system. Therefore many of the unnecessary features of commercial style VDU's were abandoned in order to provide a cheap but effective video terminal for such applications.

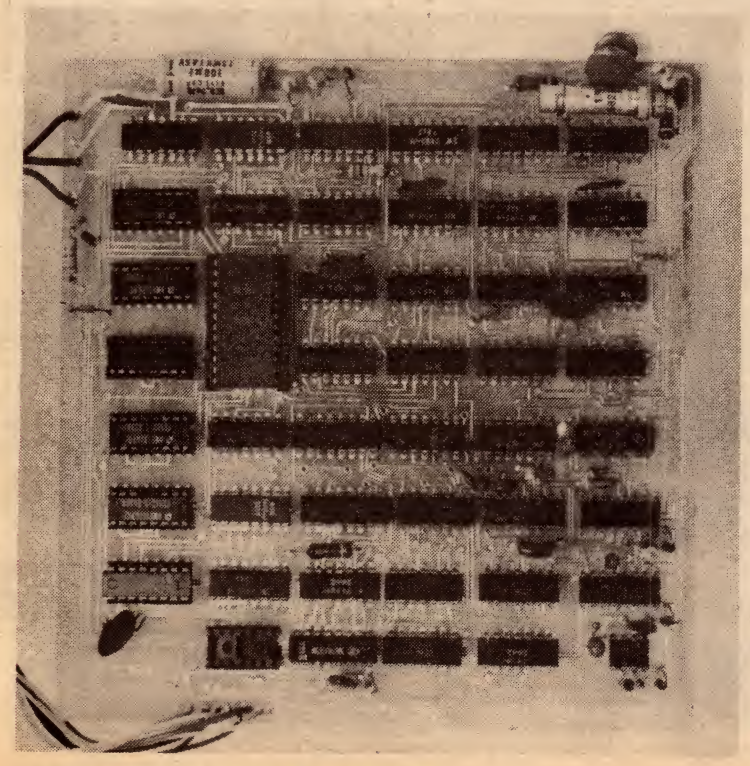
Sixteen lines of 32 characters was selected as the screen format which allows for adequate display of program steps. With continuous roll-up facility, the user can see at least his last 16 lines of information. The cursor, indicating the position of the next character is fixed permanently on the bottom line (line 16). Carriage return and line feed (non-print characters) are decoded and these are normally all that would be required for a basic unit. However, a back space control function has been included mainly for the benefit of those who might use such a unit as a TV typewriter. This control allows editing of the bottom line before a line feed is given. Back space actually types a space in the location of the cursor after moving it back one character position.

The VDU uses all standard readily available TTL IC chips, except for six CMOS memory chips and the character generator chip.

The method of actually displaying a character on a TV screen will not be described in detail here, as reference to the issue of EA for January 1977 should make this clear. The VDU described here uses the same character generator IC described in the earlier article (i.e., the 2513), and hence allows for the display of the full 64-character subset of ASCII known as "6-bit ASCII". This is the same character set displayed on most teleprinters.

A 4.7MHz crystal oscillator provides all of the clock pulses for the VDU. As can be seen from the block and circuit diagrams, this base frequency is divided down to produce the horizontal and vertical sync pulses required by the TV set. The 4.7MHz signal is also used to clock the output shift register used to convert the parallel "row data" from the character generator into the serial data required as video information by the TV display.

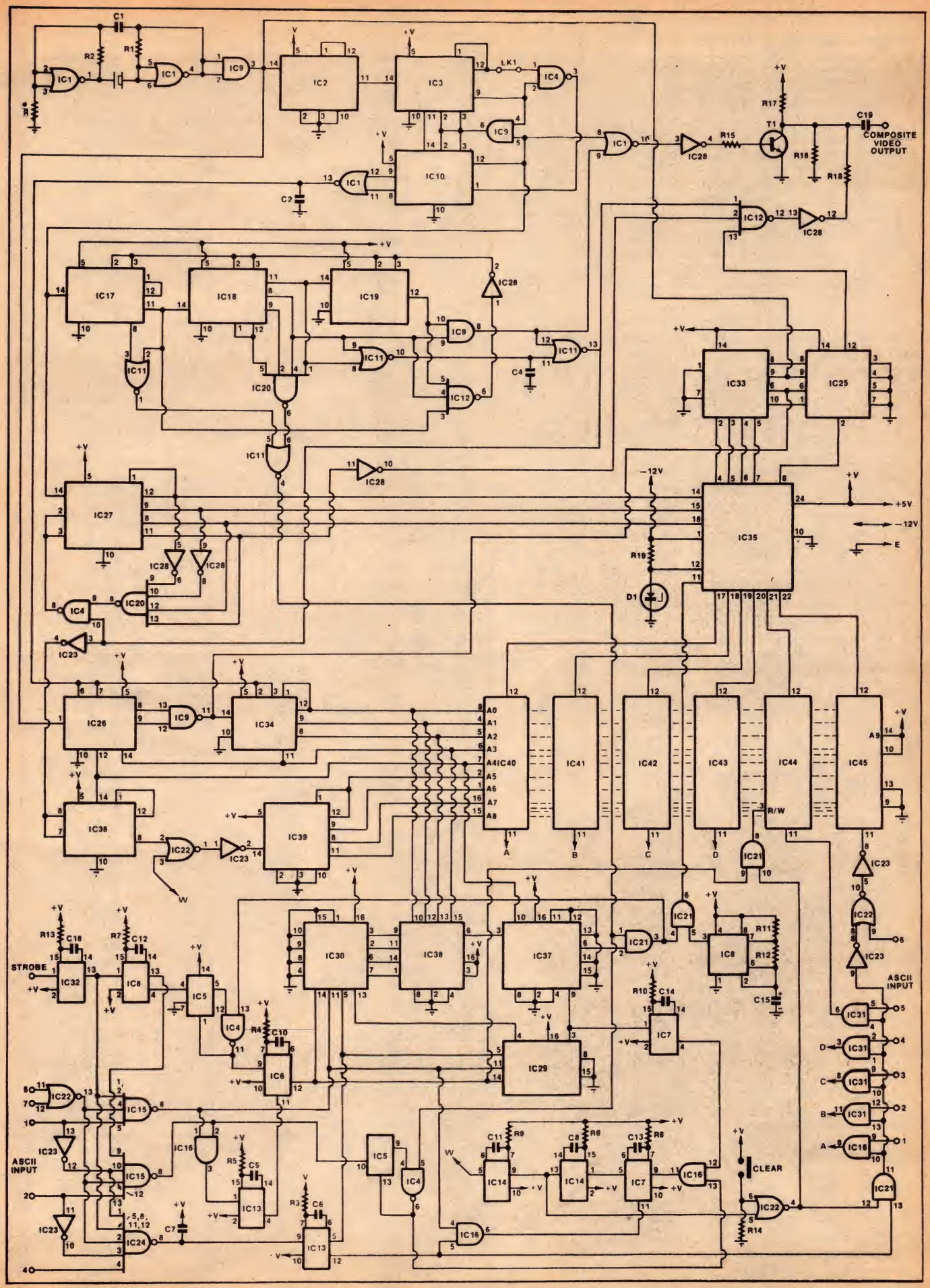
Incidentally it has been found that a 4.43MHz crystal of the type used in the subcarrier oscillator of colour TV receivers may be used instead of the nominal 4.7MHz crystal. This can be worthwhile, as the 4.43MHz crystal is generally cheaper and easier to obtain. Naturally when the lower frequency



At left is the assembled PC board. Note that the version shown here uses a 100pF capacitor paralleled by a 30pF trimmer in place of the crystal.

SPECIFICATION

VDU displays the 6-bit ASCII character set, in 16 lines of 32 characters. All timing derived from a crystal-locked oscillator; no setting up required. Continuous line scrolling of display. Maximum input data rate 50 characters/sec. Destructive back space facility for editing. Flashing cursor indicates next character position. Uses standard TTL ICs for low cost.


C1
R2
R1
IC1
IC9
IC2
IC3
LK1
IC4
IC10
C2
+V
R17
T1
C19
COMPOSITE VIDEO OUTPUT
R15
R18
IC28
IC12
IC17
IC18
IC19
IC11
IC20
C4
IC33
IC25
IC27
IC35
−12V
+5V
E
R19
D1
IC26
IC34
IC36
IC39
IC22
IC23
W
A0
A1
A2
A3
A4IC40
A5
A6
A7
A8
IC41
IC42
IC43
IC44
IC45
R/W
A9
A
B
C
D
IC21
IC30
IC38
IC37
IC8
R11
R12
C15
R10
C14
IC7
IC29
STROBE
IC32
IC6
IC5
R13
C18
R7
C12
R4
C10
ASCII INPUT
IC31
IC15
IC24
IC16
IC13
R5
C9
R3
C6
C7
C11
R9
C8
R8
C13
IC14
CLEAR
R14

Video display unit

crystal is used, both of the TV sync pulse frequencies are lower also, but most TV sets seem to be able to lock onto them quite easily. As the vertical frequency becomes 45.5Hz instead of 50Hz, some sets may produce a small amount of horizontal wavering or "snaking", particularly if there is some 50Hz ripple getting into the vertical oscillator from the receiver's power supply.

If such an effect is experienced and found annoying, then a 100pF capacitor with a 30pF trimmer in parallel may be substituted for the crystal if a 4.7MHz crystal is not available. The trimmer capacitor can be varied until the TV set locks onto the VDU sync pulses. Further trimming may be required to obtain a steady display.

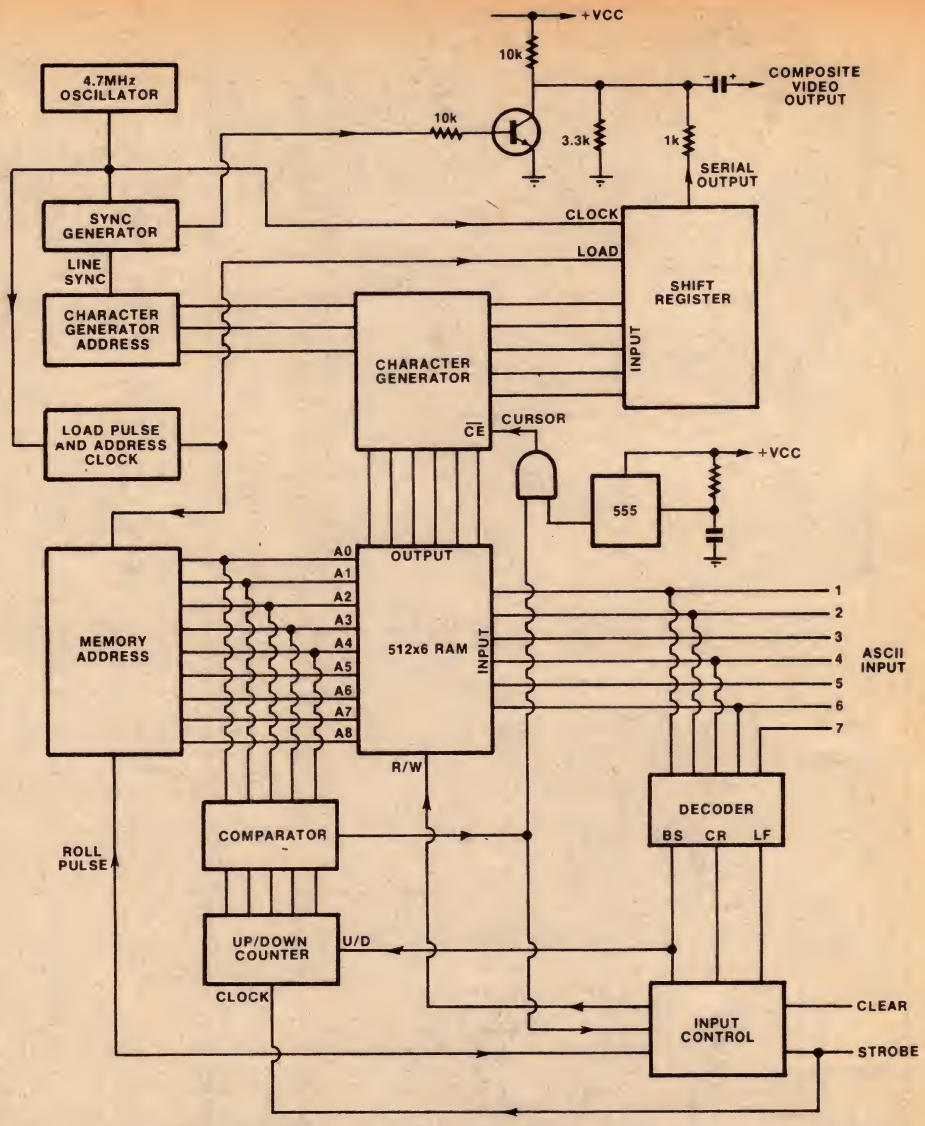
Note that if this capacitor is used, a 220 ohm resistor is required as an addition between pins 2 and 3 (joined together) on IC1 and ground. This is indicated on the circuit diagram as R* and can be soldered onto the board, vertically, from the appropriate side of R2 and the outer ground line.

A further chain of frequency dividers generates the line address information for the character generator and the load pulses for the shift register. One load pulse occurs for every six clock pulses given to the shift register, thus loading it with the required five bits of data for a character row and also giving a single "dot" space between characters. Since this load pulse occurs for each character across the screen (i.e. 32 times for each horizontal TV scan) it becomes the ideal clock pulse for the memory address.

Nine address lines are required to address the memory, which holds each character to be displayed on the screen in its ASCII code. The memory is re-addressed each frame and therefore a character remains in its particular location in memory until changed by an external control signal. The memory consists of six 2102, 1k x 1 RAMS, six being required to hold the six bit ASCII code. This provides 1024 6 bit words, but only 512 are used.

The outputs of the memories are connected directly to the character generator. The memories are normally held in the read mode and each time the address changes, the outputs from the memories change to provide a six bit ASCII code for the character generator.

As just mentioned, an external control signal is required to change data held in memory. To do this we must have a written command, together with an indication as to where in memory its contents are going to change. Memory location indication is achieved by comparators and a set of counters that duplicates the memory address. This extra set of counters are advanced one count by the input strobe pulse, which indicates that a new character is being entered either from a keyboard or a computer. The comparator gives an output when the memory address equals the count on the duplicated set of counters, and this output is used to gate the ASCII input into the correct location in memory.



Above shows the block diagram, while at right is the component overlay pattern.

Because of this gating technique, a character can only be written into memory every frame, which immediately indicates a baud rate limitation of 500 baud. Since this VDU was designed for microprocessors, this modest baud rate should not be a problem as the VDU will operate at the 110, 150 or 300 baud rates used by most debug ROMS in microcomputers.

If the output of the comparators is fed to the CE-bar input on the character generator chip, it disables the chip for that particular location, and therefore a single bar is generated on the screen. This occurs instead of generating a character and therefore a cursor appears. Since the cursor appears permanently on the 16th line, only five of the nine address lines need to be compared, thus controlling the 32 positions along the line. The blinking effect of the cursor is achieved by gating the control signal with a low frequency astable multivibrator; a 555 timer has been used for this purpose.

At this point it should be clear that we now have a "page" of information displayed on the screen with a cursor indicating the next character position. Let's now take a look at how the scrolling of lines is achieved.

The memory address counters can be divided into two parts. The first five address lines control the 32 characters across each of the 16 lines, while the 16 lines themselves are controlled by the last four address lines. If at any time an extra clock pulse is given to this last address counter it would add an extra count and thus change the character line position as they appear on the screen. If the pulse is applied to this counter during the time that there is no

PARTS LIST

INTEGRATED CIRCUITS

IC1 7402	IC16 7408	IC31 7408
IC2 7493	IC17 7493	IC32 74123
IC3 7493	IC18 7493	IC33 7495
IC4 7400	IC19 7493	IC34 7493
IC5 7474	IC20 7420	IC35 2513
IC6 74123	IC21 7408	IC36 7492
IC7 74123	IC22 7402	IC37 7485
IC8 555	IC23 7404	IC38 7485
IC9 7408	IC24 7430	IC39 7493
IC10 7493	IC25 7495	IC40 2102
IC11 7402	IC26 7492	IC41 2102
IC12 7410	IC27 7493	IC42 2102
IC13 74123	IC28 7404	IC43 2102
IC14 74123	IC29 74191	IC44 2102
IC15 7420	IC30 74191	IC45 2102

RESISTORS

R1 470 ohms	R11 10k
R2 470 ohms	R12 120k
R3 22k	R13 10k
R4 6.8k	R14 470 ohms
R5 22k	R15 10k
R6 6.8k	R16 3.3k
R7 6.8k	R17 10k
R8 39k	R18 1k
R9 22k	R19 680 ohms
R10 6.8k	R* 220 ohms

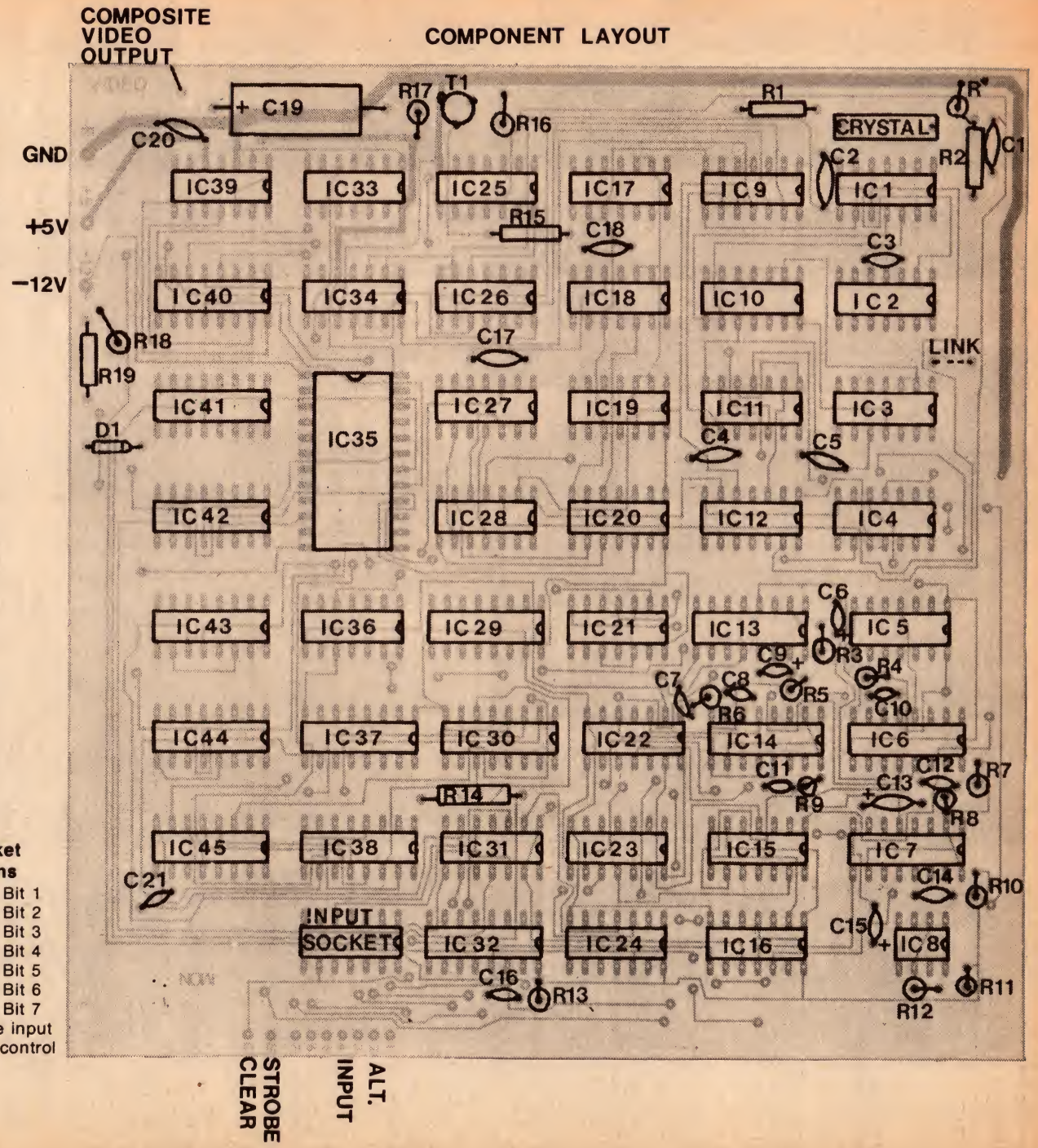
CAPACITORS

C1 .01uF	C12 330pF
C2 330pF	C13 .33uF tant.
C3 .1uF	C14 .022uF
C4 330pF	C15 4.7uF tant.
C5 .1uF	C16 .027uF
C6 3.3uF tant.	C17 .1uF
C7 .001uF	C18 .1uF
C8 .022uF	C19 47uF 25V electro.
C9 3.3uF tant.	C20 .1uF
C10 22pF	C21 .1uF
C11 .082uF	

CRYSTAL 4.7MHz
or 100pF capacitor and 30pF trimmer

D1 BZX79C5V1

T1 BC109



Input Socket Connections

Pin 1 ASCII Bit 1
Pin 2 ASCII Bit 2
Pin 3 ASCII Bit 3
Pin 4 ASCII Bit 4
Pin 5 ASCII Bit 5
Pin 6 ASCII Bit 6
Pin 7 ASCII Bit 7
Pin 8 Strobe input
Pin 9 Clear control

HAND TOOLS

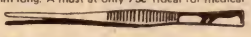
The search for new products is never ending and tools are one of the important areas we are constantly chacking. Just look through this great range and their incredible prices. It must all add up to good value. Especially when you realize how simple it is for you to get any of these great products, either send in to our mail order dept. or pop into any Dick Smith store or dealer!

.01 TRANSISTOR NIPPER for very small gauge wires. 4½" (115mm) long. Spring opening insulated handles. Similar quality normally around $7.00 $4.50

Cat. T-3200.

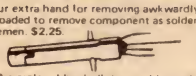
Handy Soldering Aids.

P86 TWEEZERS with very fine, sharp, straight points and non-slip jaws. 125mm long. A must at only 75c (Ideal for medical cabinet too!)



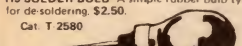
Cat. T 4630.

H3–C R PULLER your extra hand for removing awkwardly located parts. Spring loaded to remove component as solder melts. Ideal for servicemen. $2.25.



Cat. T-2600.

H9 SOLDER BULB. A simple rubber bulb type solder sucker for de-soldering. $2.50.



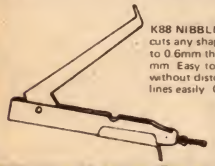
Cat. T 2580.

Cat. T 2620.

H72 HEAT SINK SET. Like alligator clips made of aluminium. A must for transistor work. $1.20.

EL–1 SOLDER SUCKER. Full metal construction – better than plastic! With Teflon tip. Simple push release thumb mechanism. Complete with nozzles weeper (!) Normal price was $9.00. Now only $8.75, spare Teflon tips avail.

Cat. T 2560.



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Cat. T 4940.

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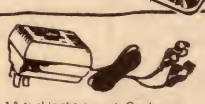
Cat. D-7104.
Only $25.00!



Cat. M-9802.

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look at this for Value!

AM/FM MULTIPLEX TUNER YFX–601–1C.

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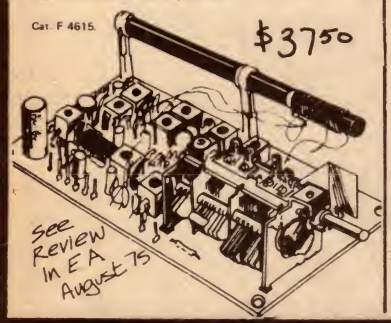
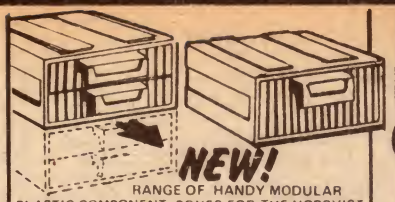
Cat. F 4615. $37.50





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RANGE OF HANDY MODULAR PLASTIC COMPONENT BOXES FOR THE HOBBYIST OR HANDYMAN

Frankly, we have seen a lot of component drawers come and go over the years. In our opinion, these are the best ones that we have come across. Check these features. Large handle on the front of each drawer. Special index card slot moulded into handle for labelling. Outside of boxes have precision dovetail ways so that boxes may be securely fitted together. Wall or bench mountable. Trays do not seize inside box as many inferior other types do. Two types available. One with 2 drawers per box (H-2585). The other has one drawer (H-2584) per box. All boxes in smart white high impact plastic with the drawers moulded in a smart red. Overall dimensions 5 1/8in D x 4.1/2in.W x 2 1/4in.H. Price is only $1.20. for either.

HUGE HI–WATT BATTERY SHIPMENT IN

Specially imported, factory fresh, high capacity, long life batteries. Just look at these prices!

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Cat. S-3002	C size metal jacket	ONLY 20c
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BURGLAR ALARM VIBRATION SWITCH. L-5250.

Rugged little switch goes open circuit when it is shaken. Ideal for plateglass windows and safes, etc. Adjustable sensitivity. Tamperproof case, rugged PVC case. 5W 50V@0.1A. Only 75in x 85in x 2.25in. $2.50. Normally closed contacts.

MINI REED ALARM SWITCH. L-5210.

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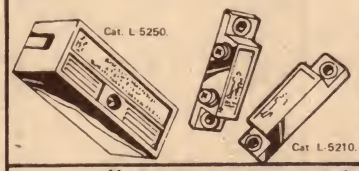

Cat. L-5250.

Cat. L-5210.

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115V trannies for foreign gear

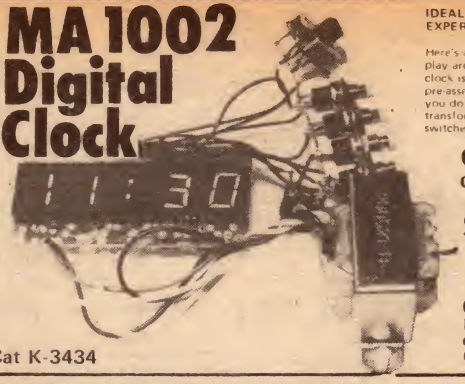
HANDS UP IF YOU WENT OS FOR THE HOLIDAYS.

Have you got a red face like many overseas travellers have buying an appliance in say Japan only to find it's for 115 volts! We can help – our 115 volt transformer is rated at 30 watts, which suits many small cassettes, radios, etc. Has normal mains flex and plug, with 115V socket to plug appliance into. Fully approved by the electricity authority.

Cat M-1158. $22.00

HEY! THAT'S A SAVING OF NEARLY $8.00!!

MA 1002 Digital Clock



Cat K-3434

IDEAL FOR THE EXPERIMENTER!

Here's a neat little kit to play around with – this digital clock is four big LED digits, and is pre-assembled on its own PCB. All you do to finish it off is add the transformer and a couple of switches.

Complete kit – chip, trans, sw.

$19.75

CHIP ONLY – MA1002 clock chip only. Cat X-1052 $13.50

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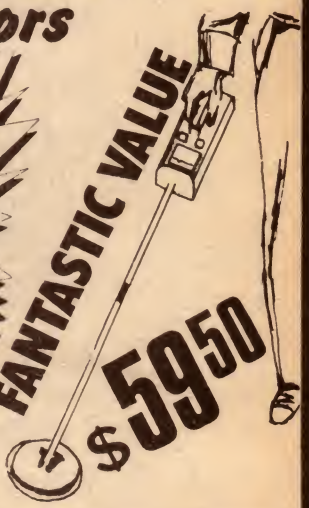
* Light indicator shows presence of metal objects

WAS $9.75 $4.75

FANTASTIC VALUE



$59.50

WHAT VALUE! This Builders Mate metal detector is ideal for finding pipes & wires in walls, or nails in wood before you saw through them and ruin the saw! UNDER HALF PRICE Cat X-1060 $4.75

FIND A FORTUNE. The quality metal detector shown at right is just the thing for searching for coins on the beach. Several stories from overseas prove that serious searchers can make the cost of one of these units back again! Cat X-1064 $59.50

Mini Cassette Recorder

NEW

What a beauty! A little cassette recorder ideal for personal recording, businesses, meetings, etc. Has inbuilt cond microphone, takes standard cassettes. You'll see elsewhere for over $80.00. Our price near half! Cat A-4050

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SUPER GLUE!

What's faster than a speeding bullet, more powerful than a locomotive, able to stick tall buildings together? A must for all hobbyists! Cat. N-1220. $2.25.

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MICROPROCESSOR MICROPROGRAMMING HANDBOOK 294 pages.

Phew! The titles almost a book in itself! Tells you what they are, how they work, and how to work them. Cat B-2346 .. .. $9.50

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DISPLAY ELECTRONICS 252 pages. Cat B-1844.

A learning as well as a doing book. Find out how all the devices used as displays work, plus build projects using them. Cat B-1844 B-1248.

CMOS COOKBOOK (woops – who forgot to take a picture?) Thousands of CMOS ideas, incredible value for the experimenter. Few only. $13.50

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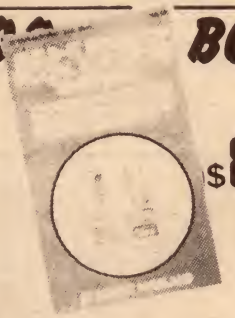

BUILD-IT BOOK OF DIGITAL ELECTRONIC TIMEPIECES 294 pp (Clocks to the mob)

This one's got the lot. All types of beaut clocks to build, with an introduction to digital timekeeping for the beginner. Real value. Cat B-1850 .. .. .. $8.95

$8.95

PROGRAMMING MICROPROCESSORS 280 pages $9.50

Yep, another book on uprocessors (you can tell which direction this scene is going, can't you!) All sorts of information for the person dealing with uprocessors – and that's YOU. Cat B-2348 .. .. $9.50

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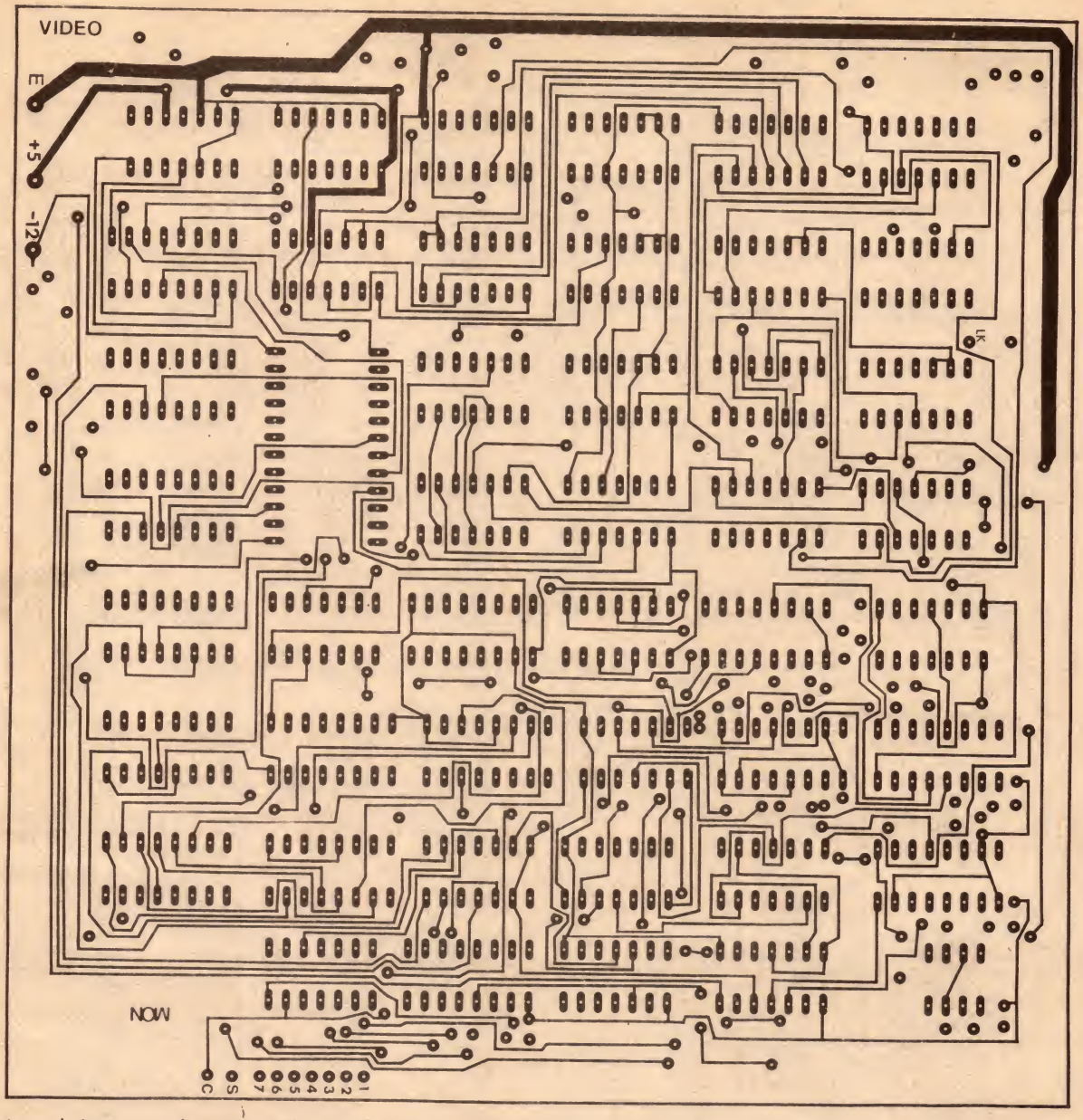


Actual size reproduction of the PC pattern on the component side of the board.

display on the screen (i.e. the time between frames) then the next time a frame appears on the screen it will start at one extra character line due to this extra count. This extra clock pulse is generated at the end of a line, or when line feed is detected, and gives the scrolling effect.

When roll-up does occur another pulse is also generated which applies the ASCII code for a space to the memories and a write command is given at the same time. This immediately gives a clear line on line 16, to type onto after the previous line is rolled up.

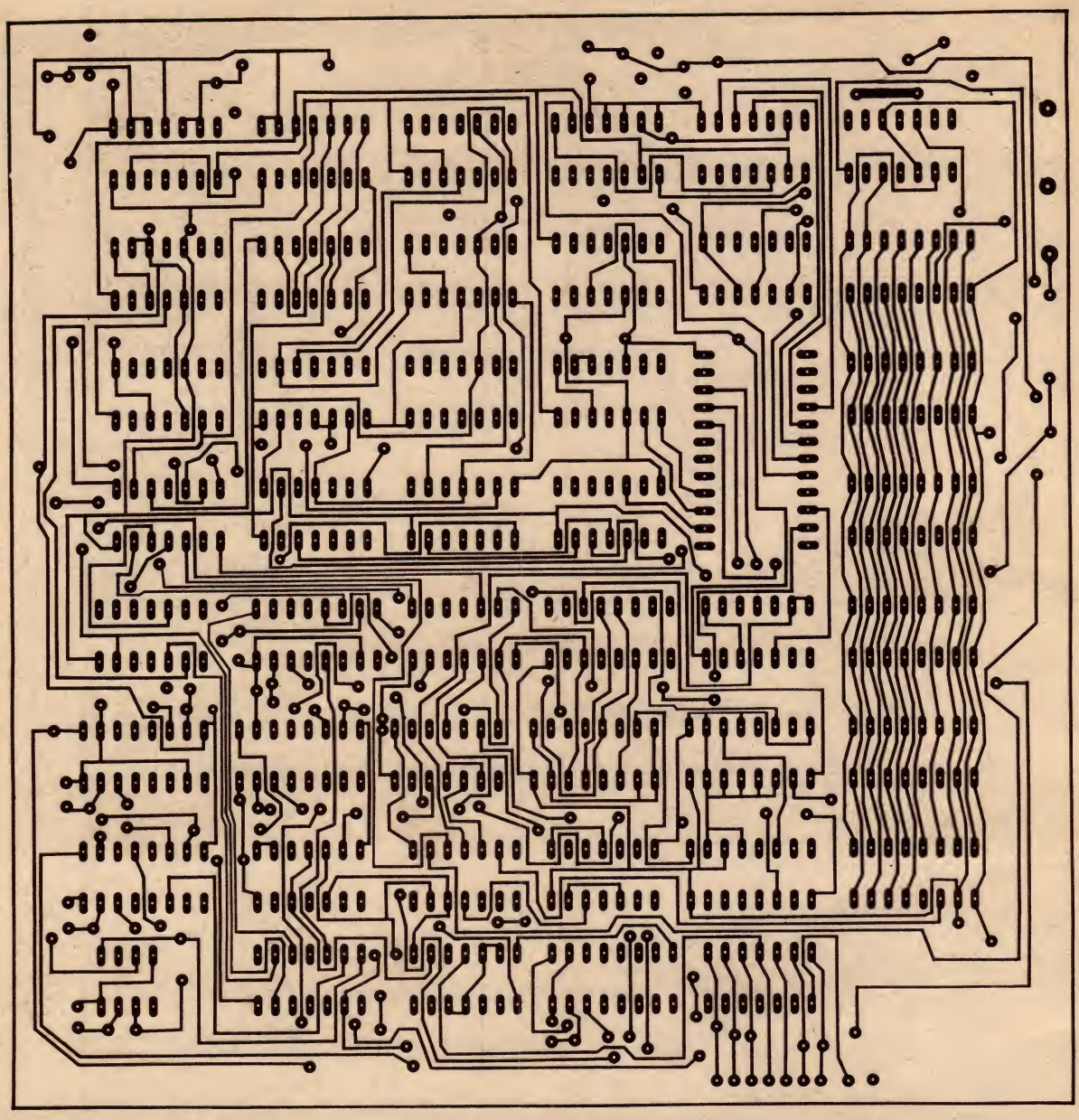
A decoder is used to detect when carriage return line feed or back space information is given to the VDU. The control bit in the ASCII code — bit 7, is used for this purpose.

The video information from the shift register is fed to the output of transistor T1 via a 1k resistor, and is mixed with the inverted sync pulses which are applied to the base of the transistor. The 10k and 3.3k resistors provide the correct 1:3 ratio for sync and video information. This composite video is then output via an isolating capacitor and is suitable for applying to any video amplifier employed in standard TV sets.

Experience has shown that the video output from the VDU is suitable for applying to the grid or the base (depending on whether valve or solid state) of the video driver in a TV set without any alteration or disconnection of any components.

When checking for this input, one should ensure that the take-off for the sync separator is after this stage of amplification in the TV receiver.

There is absolutely no setting up required with the VDU. Random characters should appear on the TV screen as soon as power is switched on. To enable a clear screen when first turned on, a clear input has been provided on the PC board. It requires a switch to the +5V rail, or a logic "1" applied to it. This can be obtained from an unused key on the terminal's keyboard, giving manual clearing, or alternatively by means of a capacitor to



The PC pattern for the reverse side of the board, again shown actual size.

the +5V supply rail, to give automatic clearing on power-up. A 47uF tantalum should work.

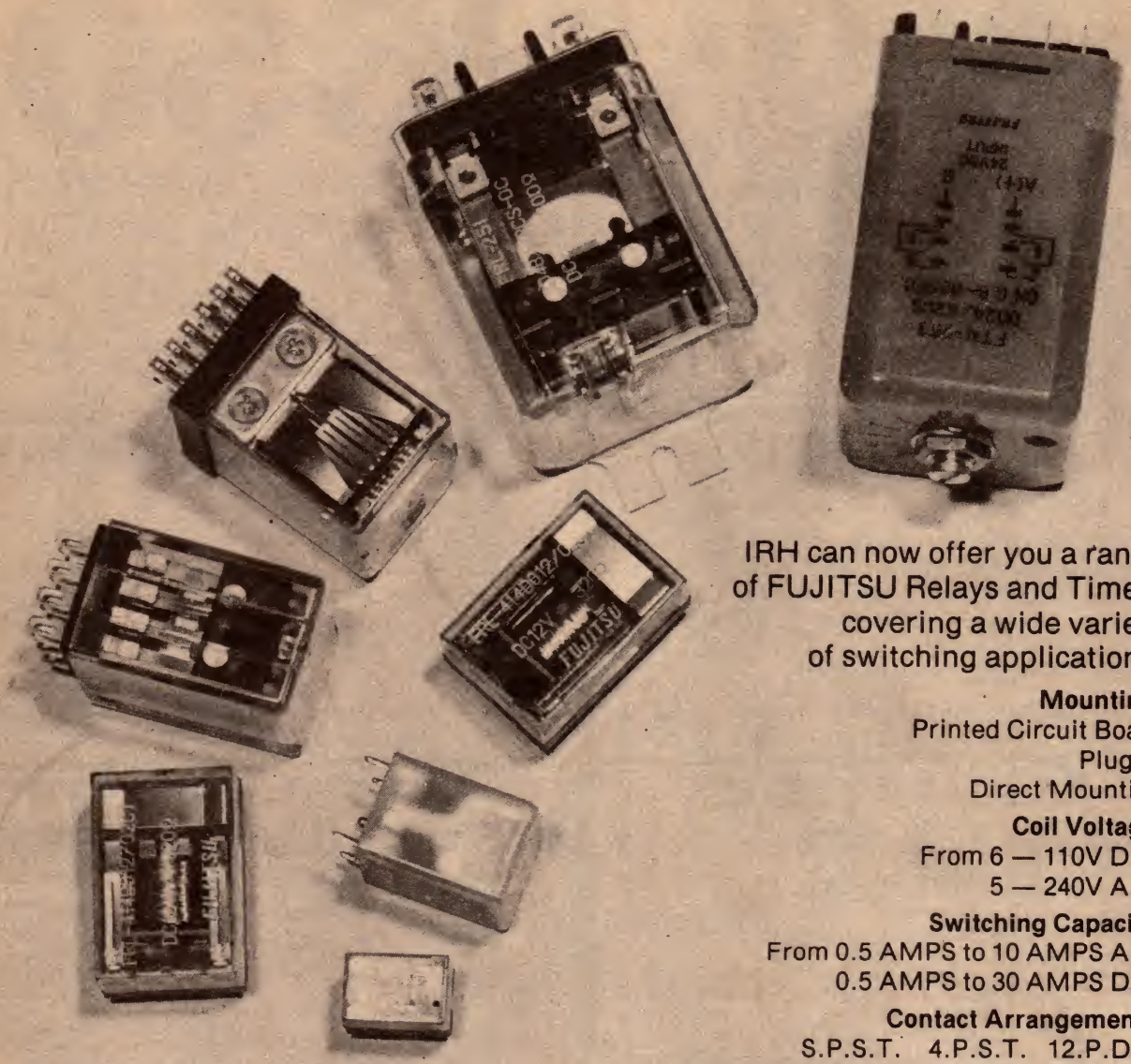
A link, LK, has been provided on the PC board to provide an option regarding horizontal positioning of the VDU display. With the link out, the video information is generated in the centre of the period between horizontal sync pulses, giving a display which should be centred on most TV sets. If, however, it is found that the display is not in the centre of your TV screen, this link can be inserted and the whole picture will be shifted about three character widths to the right of the screen.

The printed circuit board for the VDU measures 155 x 160 mm and has an input socket facility where the required input data lines can be entered via a 14 pin DIP connector, using flat ribbon cable. This makes for a very neat connection. However, for those wishing to keep costs down, the same inputs are available at the edge of the PC board where wires can be soldered directly to the copper. The strobe input is triggered by a negative edge; if this is not available, an inverter on this line would be required.

Power supply requirements are +5 Volts at 1.2 Amps and -12 Volts at around 40mA. The higher +5V supply current is required because of the TTL chips used. Three terminal regulators rated for 1.5 Amps are adequate for this voltage supply.

A UART has not been included on the PC board because the VDU was considered to be a separate self-contained control system which accepts parallel data only, and if serial data is required by a microcomputer system then an external device such as a UART should be added. Parallel data is also acceptable to some microprocessors and makes for easier programming.

Editor's Note: For those who do wish to add serial interfacing and a keyboard, to produce a complete self-contained terminal, we hope to supply the necessary information shortly.



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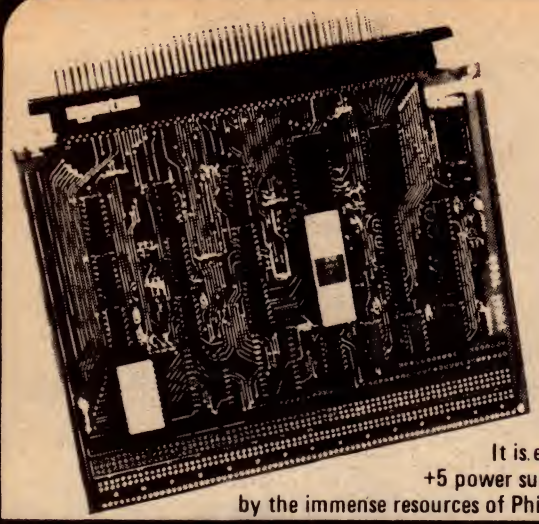

SYSTEM 2650

THE EXPANDABLE - AFFORDABLE HOME COMPUTOR SYSTEM

The 2650 by Signetics is the easy way to get into Microprocessors. In fact, the 2650 is fast becoming one of the most popular microprocessors with Australian hobbyists.

It is easy to use, easy to program and features low power static operation from a single +5 power supply. Extensive low cost software is readily available, and the 2650 is now backed by the immense resources of Philips worldwide.

"BABY" 2650

If you have access to a terminal (V.D.U. teletype, etc.) you can't beat this kit as an ideal starting point. Supplied with the PIPBUG ROM and 256 BYTES of RAM the BABY 2650 is very easy to get running after a couple of hours assembly time. Supplied with sample programs to run and full documentation.

BABY 2650 KIT.
POST AND PACK $2.50. **$75.00**

2650 CONVERSION KIT

Want to convert your BABY 2650 to a fully buffered CPU?

This kit enables you to transfer your components to a top quality plated through hole PCB with adequate provision for system expansion. When completed you have a full KT9500 system (see below).

2650 CONVERSION KIT
POST AND PACK $3.50 **$142.00**

2650 — KT9500

This is a very useful single board CPU system that can be readily expanded. Consider these features —

- ★ 1K ROM (PIPBUG EDITOR AND LOADER) EXPANDABLE ON BOARD TO 2K ROM/PROM.
- ★ 512 BYTES OF RAM EXPANDABLE ON BOARD TO 1K.
- ★ ON BOARD TTL CLOCK.
- ★ TWO — 8 BIT PARALLEL BI/DI I/O PORTS.
- ★ RS232/TTY SERIAL I/O PORT.
- ★ 100 PIN WIRE WRAP EDGE CONNECTOR SUPPLIED.
- ★ COMPREHENSIVE DOCUMENTATION.

The KT9500 is an ideal basis for a home computer.

2650-KT9500
POST AND PACK $3.50 **$199.00**

KT9500-RAM STICK MOTHER BOARD (RSMB)

This elegantly simple mother board allows you to add up to 16K of RAM/ROM AND CRYSTAL CONTROLLED CLOCK (OPTIONAL) to your KT9500 with a minimum of fuss. The 2650 RSMB also has provision for future expansion to S100 BUSS or even another RSMB. The RAM STICKS use 2102 RAMS in a 1K x 8 organisation.

KT9500. RSMB	$35.00
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RAM STICK (ASSEMBLED & TESTED)	$25.00 per 1K
RAM STICK PCB ONLY (WITH INSTRUCTIONS)	$6.00

2650 GAMES SOFTWARE PACKAGE

Here is a most enjoyable way to demonstrate your 2650 system to friends. Play games like ASTRO TREK, NIM, MASTERMIND, POKER MACHINE, TARGET SHOOT ETC. ETC. Supplied with complete listings and computer justified Cassette (110 BD PIPBUG FORMAT).

2650 GAMES PACK
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2650 USERS GROUP

If you are really sreious about the 2650, a Users Group has now been formed. Membership fee includes an extensive documentation package containing hardware and software notes. Program listings include 11 UTILITY PROGRAMS containing TEXT EDITOR, ASSEMBLER, BLOCK MOVE, DISASSEMBLER, BINARY LOADER/DUMPER, and REASSEMBLER + 16 GAMES (7 NEW GAMES).

Programs are also available on Cassette to members of the Users Group at nominal prices.

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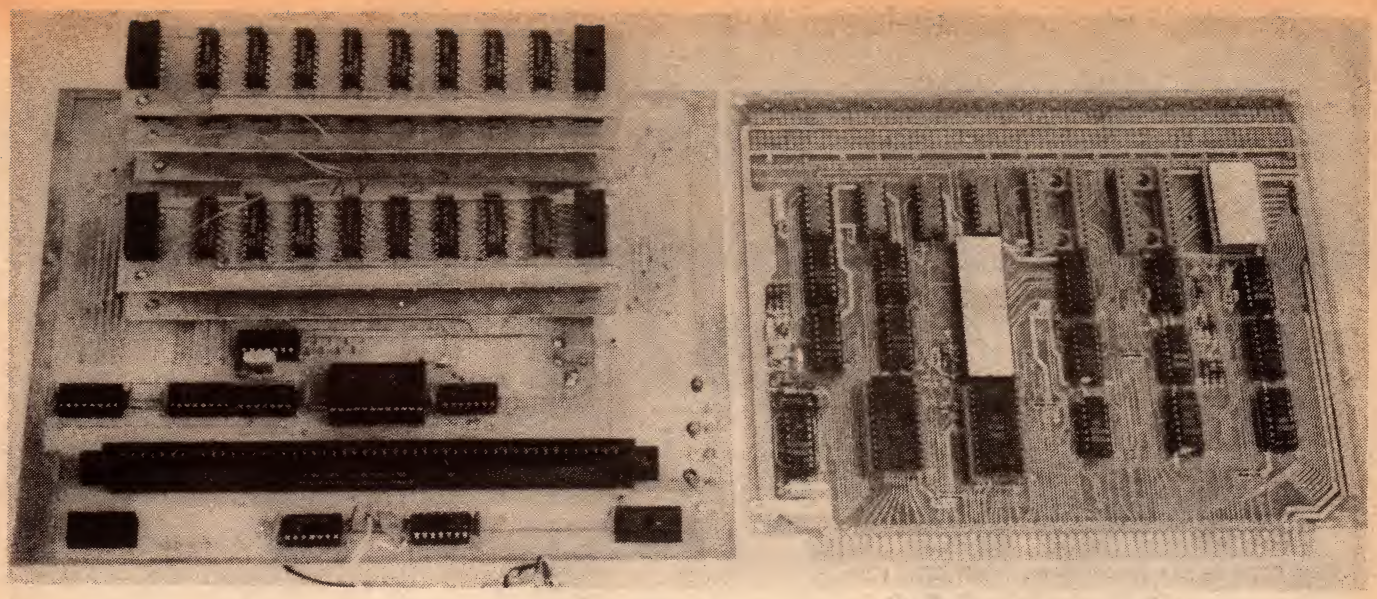

Easy expansion kit for 2650 microcomputers

Many microcomputer enthusiasts have shown interest in building up medium-scale systems based on the Signetics 2650 microprocessor. This can be done quite easily and at surprisingly moderate cost, by combining the Signetics KT9500 evaluation kit with the "RAM-stick" and motherboard system which has been developed by the local firm Applied Technology.

by JAMIESON ROWE

Computer hobbyists in Australia are currently showing a lot of interest in systems based on the Signetics 2650 microprocessor. I believe one reason for this was EA's "baby" 2650 system, which I described in the March 1977 issue. This provided a really simple and low cost way of getting the 2650 "up and running", and allowed many hobbyists to become familiar with the device and its powerful minicomputer-like instruction set.

Of course the "baby" system was very small. Although it offered the same "PIPBUG" monitor program as the larger 2650 evaluation kits, resident in a 1k-byte ROM, it provided only a modest 256 bytes of RAM for user programs. And having been designed for economy rather than ease of expansion, it was not readily expanded into a larger system.

For this reason I suggested in the original article that those who were already fairly sure they would be progressing to a larger 2650 system might be better advised to start with one of the Signetics evaluation kits, such as the PC1500 or the assemble-it-yourself KT9500.

As it happens, however, those who elected to start with the baby system can still change over to the KT9500 fairly easily — particularly if they followed our advice and used sockets for the microprocessor and monitor ROM chips rather than solder them directly into the PC board.

Applied Technology Pty Ltd has conversion kits available, so that you can upgrade from the baby system to the KT9500 at minimum cost. The conversion kit provides the 9500 PC board together with all of the required parts, apart from the 2650 microprocessor, the 2608 ROM with PIPBUG, and the two 2112 RAM chips.

With the KT9500, you have a much better starting place for an expanded system. Along with the PIPBUG ROM and 512 bytes of user RAM, there is full address decoding and fully buffered data and address bus lines. Also provided are two bidirectional 8-bit input/output ports, as well as serial input/output ports for a teleprinter, video terminal or similar device. The complete system is mounted on a PC board measuring 175 x 213 mm, which plugs into an accompanying 100-way edge connector.

Needless to say even though the KT9500 already offers enlarged capabilities, most enthusiasts find that they want to begin expanding it not long after they have it up and running. Probably the most common urge is to expand the memory, so that larger programs can be developed and run; the other urge is to replace the dual-monostable RC-timed clock oscillator with a more stable crystal clock.

To help you expand the KT9500 along these lines, Applied Technology has developed a "mother board" expansion kit which utilises their "RAM-stick" memory modules. As explained in our December 1977 issue (page 96), the AT RAM sticks are small PCB modules designed to be stackable by means of DIL sockets. Each stick provides 1k-bytes of low power static RAM, allowing an enthusiast to build up his system's memory in convenient and affordable increments.

The motherboard expansion kit assembles to form a PCB measuring 174 x 228 mm. The 100-way edge connector socket which comes with the KT9500 mounts directly on this PCB, so that the two boards now become an L-shaped assembly.

Adjacent to the main socket on the motherboard are six ICs, two of which

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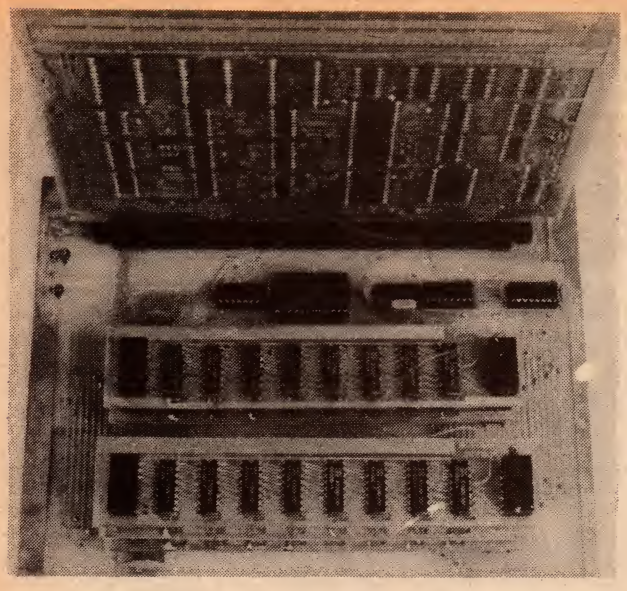

The picture on the facing page shows the Signetics KT9500 at right, with the Applied Technology mother board and "piggyback" RAM sticks at left. The picture at left shows the two when assembled together. Up to 15 RAM sticks may be used.

are used to implement a crystal clock oscillator. This uses a 4MHz crystal, with division to the 1MHz required by the PIPBUG monitor and its serial communications routines. The remaining four ICs are used for additional address decoding and data bus buffering.

The address decoding circuitry uses a 74LS154 device to decode address bits 10, 11, 12 and 13. The sixteen decoder outputs thus become enable lines for 16 contiguous memory blocks of 1k-bytes each — so that they can be used to select up to 15 RAM sticks along with the PIPBUG ROM on the KT9500. The ROM must now be driven by the new decoder, and to enable this to be done a copper track must be cut on the KT9500 PCB, and replaced with a wire link to an unused edge connector pad. The on-board RAM chips are not used.

The motherboard is provided with four undedicated 16-pin DIL sockets along the front. These may be used for connection to the 8-bit input/output ports on the KT9500, or for any other desired purpose.

The motherboard PCB is double sided, although for economy it does not have plated-through holes. The constructor is thus faced with the rather daunting prospect of soldering in some 116 through-board wire links; however while doing this you can be cheered by the thought that you are saving money!

As it happens the through-board links are the major part of the job in assembling the kit, in any case. Apart from the links there are only six ICs, twelve bypass capacitors, two resistors and the crystal. Plus the 100-way connector and the four 16-pin DIL sockets for the RAM sticks, of course. So overall the assembly shouldn't be unduly tedious or time-consuming.

Using the motherboard it is thus quite easy to provide the KT9500 with a crystal clock, and to expand its RAM by 1k-byte increments up to 15k. You can then expand the system still further, if you wish, by adding a second motherboard with up to 16 further RAM sticks.

Incidentally Applied Technology is producing a metal case suitable for housing the KT9500/motherboard assembly, together with power supplies and even a floppy disc if you plan to go that far. It should be available by the time you read this.

Prices for the various items described above are as follows, with all prices inclusive of tax. A complete kit for the KT9500 is $199, with the conversion kit for the baby system costing $142. The motherboard kit costs $35, while the 4MHz crystal costs $7.95. Wired and tested RAM sticks cost $25.50 each, but you can buy the RAM stick PCBs separately for $6 each.

One of the things that is making the 2650 microprocessor increasingly popular with hobbyists is the growing library of support software. Much of the software has been generated by hobbyists themselves, many of whom started with our baby 2650 system.

Just about all of the software that has been generated to date is available to members of the 2650 Users' Group, so that it can be very worthwhile to join. The group is associated with Applied Technology, and further information is available from them at 109-111 Hunter Street, Hornsby, NSW 2077 (telephone 02-476 4758, 476 3759. Initial membership costs $40, for which you get a documentation package with listings of many useful programs.

These include an assembler, a text editor, block move and search routines, hexadecimal input and listing routines, a disassembler, a reassembler, a tape verifier, maths routines, and many games programs including "Astro-Trek" and a Lunar Lander. Many of these programs are also available on cassette tapes, for a modest extra fee.

Next month we hope to present a few sample programs from the growing library of 2650 software, to whet your appetite. Who knows — they may spur you not only to join the Users' Group and get the rest of the library, but to write some programs of your own!

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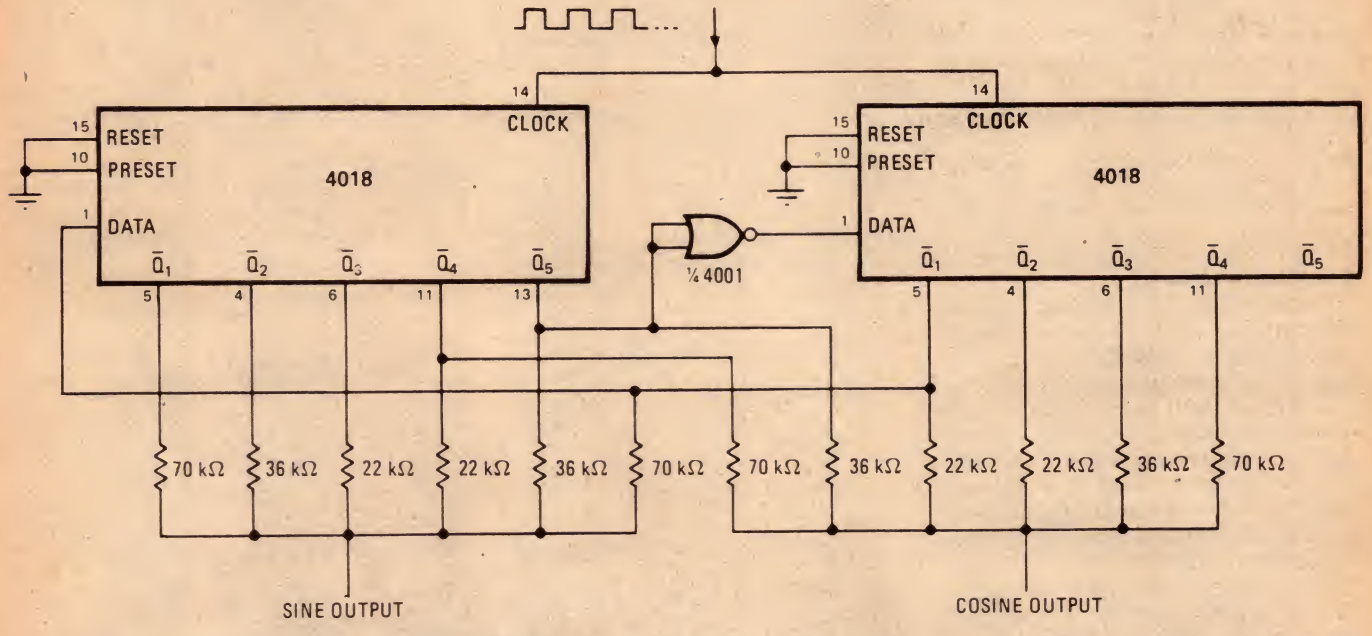
Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

Ring counter synthesises sinusoidal waveforms



A digital circuit composed of only two counters and a weighted resistor network is as good at producing sine and cosine waveforms as many quadrature oscillator networks. Because matched components are not used, design considerations are radically simplified.

Use of the digital technique eliminates many components. The upper frequency limit of the oscillator is 250kHz, and it is not affected by the frequency limitations of operational amplifiers, because no op amps are used. Tweaking the oscillator is not necessary because no special circuitry is needed. The sine and cosine waveforms are equal in magnitude at every frequency because no differentiating circuits are used. It is even possible to transform the circuit into a digital to sine wave converter with little modification, if the counter's parallel input ports are used to accept binary signals.

As shown in the figure, two cascaded 4018 CMOS ICs wired as a single ring counter are driven by the master clock. The 4018s divide the input frequency by 12. The digital clock advances the ring counter by one count on the positive clock transition and each output port moves from the high to low state sequentially.

The resulting current through the weighted resistor network at the counter's output produces a 12-step approximation of a sine wave. The output stages of the second 4018 produce a cosine wave, since it is delayed three clock periods, or one quarter of a cycle, with respect to the first counter.

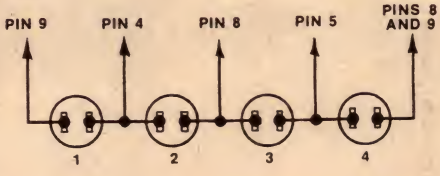
The first appreciable harmonics to appear at the output are the 11th and 13th, and they may be filtered out with a passive resistance-capacitance filter. Identical filters should be used for each counter so that the phase shift introduced is equal for both output waveforms. The input frequency may be as high as 3MHz. Above 1MHz, no filter is necessary.

(By Timothy D. Jordan, in "Electronics".)

Setting the LSI Digital Wall Clock

In the reply to R.G. in the Information Centre of the issue for September, 1977 it was stated that it was not practicable to hold the display of the Digital Wall Clock as described in July, 1976, because of the internal circuitry of the CT7001 clock chip. This is not entirely correct as the display can be held, but not with the switching arrangement supplied with that particular kit.

As I wanted to set my clock into the wall I installed four single pole push button switches on the front perspex



cover panel and wired them as shown in the sketch. They operate as follows:

(a) Set hours — push 1 and 4
(b) Set minutes — push 1 and 3
(c) Set months — push 2 and 4
(d) Set days — push 2 and 3
(e) Hold — push 1 only

To set the time to the hourly pips, use the following routine:

(a) Push switch 1 (display is held)
(b) Push switch 4 to set the hour required, then release
(c) Push switch 3 to set minutes and seconds to :00:00, then release

Wait for the final pip and then release switch 1.

(By Mr B. W. Turnbull, 37 Peacock Parade, Frenchs Forest, NSW 2086.)

PAIA 8700 Computer/Controller

Paia Electronics Inc is an American company which has specialised for some time in music synthesizers and is now branching out into the burgeoning computer hobby field. One of their new products is the 8700 Computer/Controller which is based on the MOS Technology 6503 8-bit microprocessor.

Based on the 6503, an 8-bit microprocessor made by MOS Technology Incorporated, the Paia 8700 is an applications-orientated economy system, in contrast to most evaluation and development systems produced to date.

Presentation of the Paia 8700 is neat and effective. The major part of the circuit is accommodated on a double-sided PCB measuring 248 x 152mm. Stacked on top of this is the single-sided keyboard PCB. A cutout in the keyboard PCB is provided for the two-digit hexadecimal display.

The keyboard has 24 touch-operated keys to allow entry and execution of programs. Eight of the keys are used for control functions while the other sixteen represent the hexadecimal number set. The two latched seven-segment displays show memory location and contents and can be user programmed. When entering information via the keyboard the display shows the last two digits entered.

Hardware included with the 6503 micro-processor includes 512 bytes of RAM (4 2112's) and 256 bytes of ROM which houses the resident monitor program; 2 8-bit input ports and two 8-bit output ports, one latched and one buffered. There is provision on the microprocessor board for expansion of the RAM capacity to 1024 bytes and the ROM to the same figure.

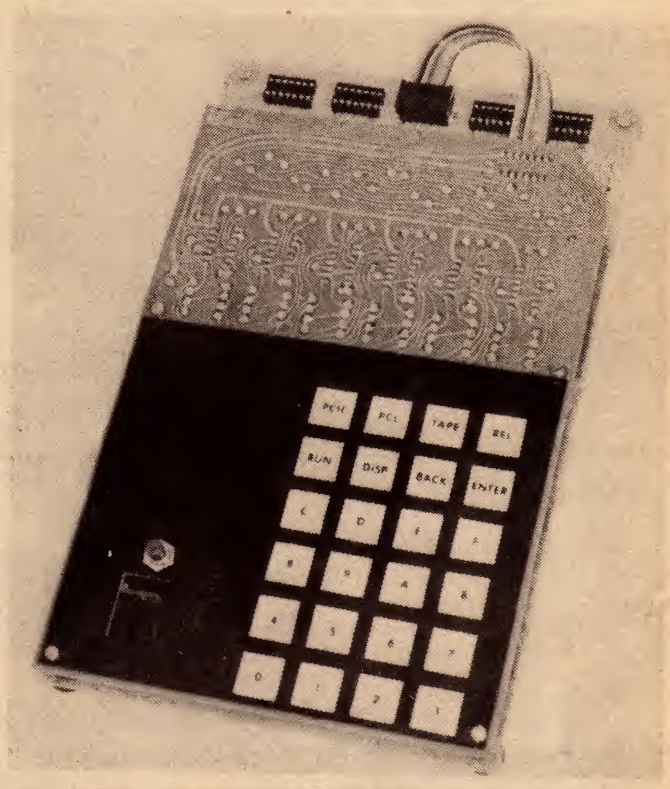
A cassette interface option is available for the 8700. We have not seen details but apparently the circuitry all fits onto the processor PCB. A feature of this circuit is that it gives an audible "beep" each time a keypad is touched.

Power requirements for the controller are 5V at 750 milliamps and minus 9V at 100 milliamps. This is most easily supplied by a modified version of the Mini-supply featured in the June 1977 issue of "Electronics Australia". We hope to publish a short article on a suitably modified version of the supply shortly.

Our sample arrived fully assembled but a quick perusal of the assembly instructions indicated that construction from a kit should be a reasonably straightforward task occupying but a few hours. Incidentally, the Paia 8700 is presently available as a special offer via the "Electronics Australia" mail order service. See the advertisement elsewhere in this issue.

A very good feature of the user manual is the section on "testing and familiarisation". Those new to microprocessor and programming concepts will greatly appreciate this section. As an introduction it uses a sample program which makes the two-digit display count from 00 to 99 and repeat.

Following instructions in the manual, the user enters the program, examines and corrects any errors and then lets it



The Paia 8700 comprises two PCBs stacked together with an active keyboard.

run. Further instructions in the manual show how to alter the speed of the program, the size of the counting steps and also make it count up in hexadecimal.

This gradual familiarisation allows the user to gain an easy introduction to a lot of the terminology. But from then on, he tends to become unstuck. Further concepts are introduced, such as Pointer (high and low) and "relative address compute" and "stack pointer". While quite well explained, the user is not told how to use them.

Further sample programs are required to enable the user to keep progressing at the gratifying rate possible in the above section. However instead, as with most other development and evaluation systems, the user now begins groping towards further familiarity rather like a blind man who is quite confident in the city but has never been in the bush!

A good deal of additional information is provided in the user manual. There is a fairly comprehensive system analysis which details input and output port address, interfacing, display and keyboard address and so on. In addition, there is a complete listing and flowcharts of the monitor program, schematics and a diagnostic test procedure. All very useful to the cognoscenti, to be sure, but merely tantalising and frustrating to the novice.

MOS Technology's 6500 series programming manual is also included in the basic price. This 240-page document gives the microprocessor architecture and full instruction set.

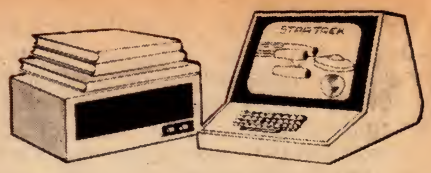
Our main criticism is that more information is required on the actual applications envisaged for the 8700. Nowhere in the literature is this more than hinted at, at present. As with other suppliers in the microprocessor field, its really a matter of "Here is the product. It's up to you to find out how to use it."

Our overall reaction to the Paia 8700 can be given from two viewpoints. From that of the well-informed user, the price of the 8700 seems very favourable, considering the hardware included and the neat and effective presentation. Presumably, the provision of interfacing facilities should make it relatively(!) easy to apply the 8700 to control applications.

However, from the viewpoint of the novice, the 8700 kit or its completed version does not offer an easy and comprehensive introduction to microprocessors and programming. Nor, for that matter, do any of the microprocessor evaluation kits! That product has yet to be realised.

Further information on the Paia 8700 can be obtained from the Australian distributors for Paia equipment, Computer Art and Education, P.O. Box 147, Croydon, Victoria, 3136. For the next three months, the 8700 will be available from the "Electronics Australia" mail order service, as noted above. (L.D.S.)

Microcomputer News & Products

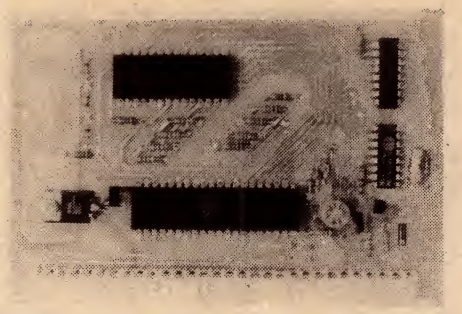


"Cruncher" interface

Southwest Technical Products has released a Calculator Interface module for the SWTP 6800 microcomputer system, based on the National Semiconductor MM57109 Number-Oriented Processor chip. The module is available as a kit, and comes complete with full data on the MM57109, details of suitable software driver routines for the 6800, and even a listing of a complete calculator-simulation program.

The module assembles on a double-sided PCB with plated-through holes, measuring 90 x 135mm. On the PCB are the MM57109 "number cruncher" chip, a 6820 PIA chip used for interfacing, two CMOS chips used for housekeeping and a 7805 regulator IC, along with minor parts.

When connected into the 6800 system, the module provides a dramatic extension of the system's numerical computation power. It features reverse Polish notation, floating point or scientific notation with 8-digit mantissa and



two digit exponent, square root and square, trig functions, natural and base-10 logarithms and antilogarithms, degree-radian conversion, inversion, and all of the normal calculator functions. There is also overflow error indication.

Interfacing of the module is fairly straightforward, so that it may also be compatible with systems other than the SWTP 6800.

Further information on the MP-N Calculator Interface kit is available from the SWTP distributors Paris Radio Electronics, PO Box 380, Darlinghurst, NSW 2010.

Newcastle micro club

Newcastle Microcomputer Club is now well established, as shown by some of their news sheets recently received.

The club meets on the second and fourth Mondays of the month at 7pm in Room GO3 of the Engineering building at the University of Newcastle, in Shortland. Visitors are always welcome.

Further information is available from Mr Brian L. Hill, 5 Kalinda St, Blacksmiths, NSW 2281 (telephone 71 1088).

National 64k ROM

National Semiconductor has announced a new 65,536-bit N-channel MOS mask programmed ROM, the MM5235 "Maxi-ROM". Organised as 8,192 words of 8 bits, the new ROM is fully TTL compatible and has a typical access time of 450ns. It runs from a single +5V supply, consuming less than 700 milliwatts.

Containing the equivalent of about 80,000 transistors, the MM5235 chip is only 25 square mm. Unlike most 4k, 8k and 16k MOS ROMs, the new device uses a triple ion-implanted metal gate process which National claims to offer several advantages for high density ROM designs.

National see the new ROM as offering an economical hardware solution to software problems. Interpreters and compilers for high level languages such as BASIC, APL and FORTRAN can now be supplied in a single ROM package, at significantly lower cost than before.

Apparently the MM5235 is the first of a family of super-dense ROMs planned by National. Designs for 128k and 256k devices are on the drawing board, and may appear within two years.

Canberra club, too

A microcomputer club has been established in the Canberra area. Called MICSIG, which stands for Microprocessor Special Interest Group, it meets on the second Tuesday of the month at 7.30pm in Building 9 at the Canberra College of Advanced Education. The club is affiliated with the Canberra branch of the Australian Computer Society, and caters for both hobbyists and professionals.

Fees are identical for both ACS and non-ACS members, being $5 for normal members and $2 for people under 18, over 60 or registered unemployed. Membership brings a monthly newsletter with news, product reviews, and articles on hardware and software of interest to members.

Further information is available from the Convenor, Mr Peter Harris, MICSIG, PO Box 118 Mawson, ACT 2607.

New interface chips

Three new interfacing and peripheral communication devices for microprocessors have been announced by Signetics Corporation. One is a programmable communications interface (PCI) chip, the 2651, which combines the functions of a USART and a baud rate generator in a single 28-pin DIL package.

The device offers programmable data formatting, and 16 programmable data rates — from 50 to 19200 baud. Alternatively an external clock source may be divided by 1,16 or 64.

The 2651 is fully TTL compatible and operates from a single 5V supply. Its addressing scheme is straightforward, making it compatible with most of the popular microprocessors.

Also announced by Signetics are the NE590/591 addressable peripheral drivers, which are high-current octal latches with Darlington power outputs. Both are capable of 250mA output current, the NE590 have open-collector outputs and the NE591 open emitters.

The third device is the NE5018, a self-contained monolithic 8-bit digital-to-analog converter which includes octal input latches for simple interfacing to microprocessor systems. The chip includes a stable 5V reference and a high slew rate buffer amplifier, and may be set for bipolar as well as unipolar operation. It is accurate to within +½ bit in the LSB position.

Further information on any of these new Signetics devices is available from the Electronic Components and Materials division of Philips Industries, 67 Mars Road, Lane Cove, NSW 2066.

Second CCD source

Intel Corporation and National Semiconductor have signed an agreement to share the design of Intel's 65,536-bit charge-coupled device (CCD) memory chip, the 2464. Intel is to supply National with the tapes and working plates for the device, while National will conduct its own wafer fabrication, assembly and testing of the product to standard 2464 specifications.

The 2464 CCD memory chip is organised as 256 short loops of 256 bits each. This gives an average latency time of 130us. The device comes in a standard 18-pin DIL package, and is fully TTL compatible.

The Intel-National agreement will ensure that a true alternate source of the device is available for high density 64k CCD memories.

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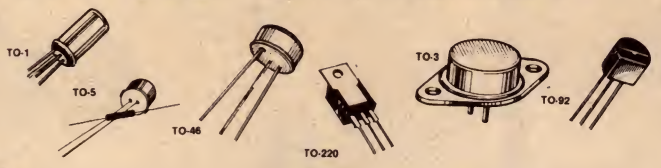

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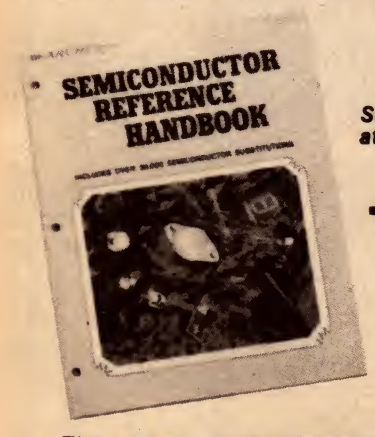

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RS-2002	Gen.Purpose Audio Amp	200	25	...	150	150	NPN	TO-1	276-2002	1.39
RS-2003	RF/IF Amp and Oscillator	50	20	0.5	10	75	PNP	TO-1	276-2003	1.39
RS-2004	Gen.Purpose Audio Amp	170	25	25	75	95	PNP	TO-1	276-2004	1.39
RS-2005	Gen.Purpose Audio Amp	150	25	1.5	200	135	PNP	TO-1	276-2005	1.39
RS-2006	Power Audio Amp	30W	30	30	7A	80	PNP	TO-3	276-2006	2.39
RS-2007	Gen.Purpose High Frequency Amp	150	30	25	300	40	PNP	TO-5	276-2007	1.39
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RS-2008	Med. Power Amp	1W	300	7	30	40	NPN	TO-39	276-2008	1.39
RS-2009	Gen.Purpose Amp and High Speed Switch	600	60	5	800	50	NPN	TO-92	276-1009	.99
RS-2010	Low-Level, Low-Noise High-Gain Amp	360	60	6	50	250	NPN	TO-92	276-2010	1.19
RS-2011	RF/IF Amp and Oscillator	600	30	3	50	20	NPN	TO-92	276-2011	1.39
RS-2012	High Voltage,Power Switch	800	300	7	150	35	NPN	TO-92	276-2012	1.69
RS-2013	Gen.Purpose, Low Frequency Amp	350	50	4.5	50	250	NPN	TO-92	276-2013	1.19
RS-2014	Gen.Purpose Audio Amp	360	50	5	800	100	NPN	TO-92	276-2014	.99
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RS-2016	Gen.Purpose Amp and Switch	360	60	6	200	100	NPN	TO-92	276-2016	.99
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Classical Recordings

Reviewed by Julian Russell

Bartok: first class playing and engineering

BARTOK — The Wooden Prince. Complete Ballet. New York Philharmonic Orchestra conducted by Pierre Boulez. CBS Stereo SBR 235847.

Bartok never had much luck with his stage works. Of his two ballets, one (the Miraculous Mandarin) was banned on the grounds of the obscenity of its story — and did no better when modified.

The Wooden Prince, reviewed here, suffers from a story that dithers tiresomely throughout. The opera, Bluebeard's Castle, despite its delectable music and deep psychological insight, is too static in action to make much of a show on stage.

There is a story, which I haven't been able to verify, that all three pieces receive regular performance in Hungary. Elsewhere you will be lucky to stumble across one of them, though Bluebeard is luckier than either of the others. All three were written at about the same period and disappointed the composer so much that he wrote no more stage works during the remainder of his life. And this despite a highly successful first night of the Wooden Prince.

It would be pointless to recount the ridiculous story of the Wooden Prince here. In any case it is set out fully on the back of the record sleeve to be checked by anybody who may be interested.

Bartok used a huge Heldenleben-type orchestra, as did Stravinsky in his original version of his early ballet The Firebird — to which Bartok's score owes occasional allegiance — and makes some use of Magyar folk songs. But despite the size of his orchestra, Bartok uses it with the discretion of a Mahler, engaging all his forces only rarely and then with the greatest sensitivity. He also uses a few juicily romantic melodies better suited to a stage production than a concert hall performance. At least these melodies, though sometimes quite banal, do suit the action.

But despite its faults, which are not nearly so glaring as they seem to be when written about, the recording should find acceptance with Bartok admirers, of which I am most definitely one. The average listener will need to play it two or three times before really appreciating it, though it's by no means "difficult" Bartok. Like much ballet music, it is episodic, so that for a start you can pick out bits you like best.

The playing and engineering are first-class.

☆ ☆ ☆

BRITTEN — Suite on English Folk Tunes. Four Sea Interludes from Peter Grimes. Passacaglia from Peter Grimes. New York Philharmonic Orchestra conducted by Leonard Bernstein. CBS Stereo SBR 235862.

These folk songs were one of Britten's last compositions before his death, and were played for the first time at the 1975 Aldeburgh Festival. It is therefore extremely likely that they will be "new" to most listeners. But this will not prevent most of them being immediately recognisable as English folk songs.

Britten and Bernstein must have made a strange pair of friends, what with Britten a retiring Englishman and Bernstein a typical American extrovert in both professional and private life. Indeed this difference shows up slightly in the performances, which are sometimes presented a bit on the showy side.

I find it difficult to guess just how Britten managed to collect these songs from all parts of his country. Our own restless collector of folk songs, Percy Grainger, encouraged by his friend Grieg, was anything but shy, and would not hesitate to stop a ploughman at his work to take down what he was singing. I cannot imagine the ailing Britten doing anything like that!

Some of the songs are sweet and some vigorous as if sung in a tavern, or wherever there was some energetic merriment dominating the scene. A few of them, particularly the fast ones, don't sound particularly English under Bernstein's nervous — I don't mean frightened — baton. But they're all well worth having, even if you only play one or two at a time.

The Peter Grimes excerpts are another matter. In Grimes, while using his own highly original style, Britten's appeal was more universal. There is raw humanity in his picture of an east-coast English fishing village with its sharply sculptured characters.

Bernstein gets just the right atmosphere of sombre strength in the first of the interludes, though here and there you will find a bar which I doubt would have pleased the composer very much. This I think is due to the ineradicable difference between the English and American temperaments.

By this I do not wish to disparage Bernstein's performance, which is fine throughout. And I don't think the difference in temperament is great enough to worry those used to the Aldeburgh style.

Bernstein not only obviously loves, but also respects the music deeply. Personally I liked his playing of the Passacaglia best, though he has a grand time during the storm. Both engineering and playing are faultless.

☆ ☆ ☆

FAURE — Incidental Music to Maeterlinck's Pelleas and Melisande. FRANCK — Symphony in D Minor. New Philharmonia Orchestra conducted by Andrew Davis. CBS Stereo SBR 235843.

Maeterlinck's subtle, shadowy play Pelleas and Melisande inspired much music soon after its original production. Composers as different as Debussy and Scholenberg all found something to say musically about it, though each in his own style.

The best known, of course, is Debussy's great opera, one of the four greatest of this century (though composed just at the end of the last). The other three in my opinion? Strauss' Elektra, Janacek's Jenufa and Berg's Wozzeck.

The music on the disc under review is taken from incidental music written by Faure for a London performance of the stage play. The many pieces were collected and made into this suite, though there is some doubt if Faure orchestrated them all himself. Evidence seems to point to some having been scored by Faure's great teacher and orchestrator, Koechlin, who understood his talented pupil very well.

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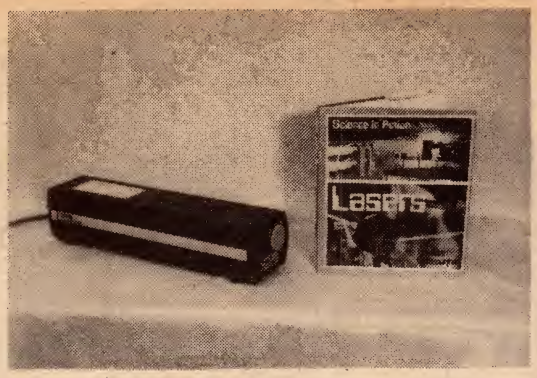

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It is difficult to find anything more different in style between Faure's Apollonian approach and Debussy's impressionism, though Faure's music reflects the atmosphere of this strange play perhaps a little more explicitly than Debussy's. The first piece describes the famous fountain scene, the next the dramatic sequence where Melisande is spinning while talking to Pelleas, spied on unknown to them by the reluctant child Yniold at the urging of Melisande's insanely jealous husband Golaud.

Then comes Sicilienne, though I have no idea where this would fit into the play. It is full of charm and is the one piece we are sure was scored by Koechlin. It is a delicious piece of delicate sound, exquisitely played and recorded. The fourth and last piece prepares one for Melisande's pitiable death. This it does most eloquently, highlighting all the tragic unfairness of the event.

On the reverse side you have Franck's D Minor Symphony. The music of this Belgian-born French composer is quite different from Faure's and is in some disrepute among the younger generation of musicians today. I still find a good performance well worth listening to and so, apparently, do many other music lovers.

Davis' approach to the music is at once reverent in both senses of the word. Here you have a perfect revelation of the pious character of the composer who, however, is never loath to work up excitement in his work whenever he thinks it needs it. But under Davis the more forceful passages are never over done.

You will find, however, plenty of beautifully controlled passion, even drama. Indeed this is as fine a performance of the symphony that I can recall hearing for many years.

☆ ☆ ☆

TCHAIKOVSKY — Piano Concerto No. 1 in B Flat Minor. Lazer Borman (pianist) with the Berlin Philharmonic Orchestra conducted by Herbert von Karajan. Polonaise from Eugene Onegin. Berlin Philharmonic conducted by Karajan. DGG Stereo Cassette 3300 677.

The redoubtable Herbert von Karajan is too old a hand at recording to put up with the sort of thing described in the following cassette. Not for him an almost inaudible orchestra in important passages. Having sized up his "opponent" — not a difficult job as he's a giant — he plays the few introductory bars of the concerto with a pugnacity that seems to tell him "Try that for size" — which Berman, a magnificent pianist does.

Berman responds in kind, in no way intimidated. He returns blow for blow and the boys settle down to a grand performance. This is the first time I have heard Berman play and very impressive he is. The splendid engineering gives them both a fair go and if you are at all like me you will settle down to hear one of the best performances of the work ever recorded.

It is an exhibition of great power and distinction by all concerned. Sparks fly everywhere but the principals are equally matched. The recording engineer has given them both plenty of room by providing a very wide range of dynamics.

At times some of this detail is of the most delicate kind with conductor and soloist in perfect rapport. There are lovely contrasts of response in the quieter second movement — and indeed in many parts of the first, too, for this is no slogging match.

The pianist's most refined passages are reflected in mirror image by the orchestra. And all through the dynamic control could not be bettered. I have never heard the fragile figurations that surround the orchestra in the second movement played with more refinement, but at the same time every note of the orchestra can be heard. Berman starts the Finale briskly with wonderful rhythm, but Karajan never forgets to let you know that he is still there.

If this performance is a fair sample of Berman's playing let's hear a lot more of it, especially with a partner like Karajan. You're not likely to hear a better — or bigger — reading than that by this combination for a very long time.

☆ ☆ ☆

RACHMANINOV — Piano Concerto No. 3 in D Minor. Tamas Vasary (piano) with the London Symphony Orchestra conducted by Youri Ahronovitch. DGG Stereo Cassette 3300859. Also issued on disc.

I listened to this work in cassette form, though it is also issued on disc. Vasary's reading is very romantic indeed, with the cleanest imaginable figuration over the orchestral theme that follows. It is, in fact, a little too clear because there are times when the orchestra can hardly be heard at all.

The slow movement Vasary takes very slowly indeed, in keeping with his generally ultra romantic reading of the whole work. He also plays it very quietly, though later in the movement he gets a genuine fortissimo. But you still have the impression that the piano part is too forward at the expense of the orchestra though this may not be so in the disc version.

The engineering is by no means one of DGG's best. Even when the orchestra does assert itself in dominant passages, the sound is slightly confused.

Side Two doesn't offer very much bloom on the strings, and as soon as Vasary clangs his way into the Finale the orchestra fades away again. I am afraid I cannot recommend this particular cassette with any enthusiasm.

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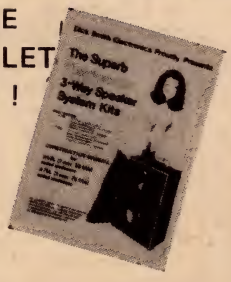

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Lighter Side

Reviews of other recordings

Devotional Records

LOVE BROKE THROUGH. Phil Keaggy and the Jubilation Group. Stereo, New Song NS-002. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

Written in the idiom of the "now" generation, the jacket notes trace the emergence of the many influences which have produced modern rock. But the writer takes a sideswipe at the meaningless lyrics and offers an alternative with personal and spiritual significance. The lyrics are given in full and reinforce the already clear diction.

The music itself is straight rock sound, ably produced by the Jubilation Group reinforced, I would judge, by other professional musicians, as mentioned in the credits. And the sound quality from the fully imported American pressing is excellent.

Track titles are: Love Broke Thru — Take Me Closer — As The Ruin Falls — Wild Horse — Disappointment — Time — Portrait — Just The Same — Things I Will Do — Abraham. The devotional theme climaxes in the last two tracks.

A good devotional album in the modern idiom. (W.N.W.)

☆ ☆ ☆

PRAISE HIM! PRAISE HIM! The Rick Powell Childrens Choir. Stereo, Singcord ZLP-3010S. (From S. John Bacon Pty Ltd, 13 Windsor Av, Mt. Waverley Vic. 3149.)

Although published in Australia on an American label, the recording was actually made in the Pye Studios in London.

In strong contrast with the current rash of Gospel rock albums, this one is built around children and the kind of children's songs which have, for several decades, been on the lively fringe of conventional church hymns. The difference is that the children here have had the advantage of a professional mentor and conductor and as much professional orchestral backing as he deemed desirable.

The titles: Praise Him — God/God Is So Good — I Just Keep Trusting My Lord/What A Friend — Show A Little Bit Of Love And Kindness — Onward Christian Soldiers — Do Lord — Hallelujah —Amen, Brother — Happiness Is The Lord — Jesus Loves Even Me/Jesus Loves Me.

Many of the titles are well known in this country and should strike an immediate rapport at family level. The sound quality is excellent. (W.N.W.)

☆ ☆ ☆

UNDYING LOVE. Ben Markley. Arranged and conducted by Bob Krogstad. Stereo, Singcord ZLP-3004S. (From S.John Bacon Pty Ltd, 13 Windsor Av, Mt. Waverley, Vic. 3149.)

As pictured on the cover, Ben Markley is a young man in his middle twenties who reminded one member of my family (and I quote) of a "young Billy Graham". What is surprising, from one still apparently young, is the maturity and assurance of his voice, which ranges from bass, through a powerful baritone, to an almost gentle tenor. What is more, this is his first album.

Backed by a full orchestra, and with excellent diction, he presents 10 devotional songs, a couple of them traditional but the rest mainly from the "Singspiration" collections: Undying Love — His Love — All Your Anxiety — Bring Back The Springtime — It Was For You — Far Beyond — May I Introduce You? — I Surrender All — Jesus Led Me All The Way — He Giveth More Grace.

The recording is clean and, thanks to the voice and orchestra, and to the engineering, the whole album has a full, rich sound. As a traditional Gospel singer, Ben Markley strikes me as one of the most promising I have ever heard. In fact that puts him down somewhat; he's well up front with his very first album. Recommended. (W.N.W.)

Instrumental, Vocal and Humour

RODRIGO:Guitar Concerto: Concierto De Aranjuez (1939) Fantasia Para Un Gentilhombre (1954). Narciso Yepes, guitar, with the National Orchestra of Spain. Decca stereo SPA 233.

Rodrigo's guitar concerto is more widely known these days via the popular tune "Aranjuez, Mon Amour" which is based on the second movement. Buy this album to get the whole experience and obtain more satisfaction from knowing and appreciating the second movement in its original context.

The other composition, Fantasia Para Un Gentilhombre otherwise known as "Fantasia for a Courtier" was composed by Rodrigo in 1954 and dedicated to Andres Segovia. Based on dances and tunes written in 1667 by one Gaspar Sanz, the Fantasia conveys the mood of that period.

At Decca's economy price, the album is worth adding to your collection if you do not already have these works. Recording quality is reasonably good, although some listeners will notice a degree of tape hiss. (L.D.S.)

☆ ☆ ☆

VIENNA. Chicago Symphony Orchestra conducted by Fritz Reiner. Stereo, RCA Gold Seal reissue AGL1-1269. Also on cassette AGK1-1269.

I imagine that most enthusiasts will have a "Vienna" album in their collection. If you don't and if you want one, this RCA Gold Seal album would allow you to fill the gap quite economically. It contains three waltzes in side 1 by Johann Strauss Jr: "On The Beautiful Blue Danube", "Emperor Waltz" and "Morning Papers".

On side 2 is Weber's "Invitation To

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

THE LIGHTER SIDE

Dance", Josef Strauss' "Village Swallows" and Richard Strauss' waltzes from "Der Rosenkavalier".

While the sound from the Chicago Symphony has plenty of body, Fritz Reiner wins from it the dynamics and the lush romanticism that is appropriate for such music. Nor is this an accident; the notes point out that Fritz Reiner gained considerable early experience as a conductor in Vienna and that key members of his orchestra also had Viennese training.

While a reissue, it has been remastered in the meantime and the sound quality is entirely acceptable. (W.N.W.)

☆ ☆ ☆

ROLLERCOASTER. Music from the original motion picture soundtrack. Composed and conducted by Lalo Schifrin. MCA 2284. Astor release.

"Rollercoaster" was the third film to feature the "Sensurround" soundtrack effects, and deals with an amusement park plagued by a maniacal extortionist. Apparently the sound track was composed while the film was being shot, which is supposed to be unusual. It seems the right way to go about it to me.

The music does seem to be coherent, and makes interesting listening in its own right, but finding a suitable occasion to play it might be difficult. (When do you play horror music?) There is no mention on the cover as to whether any Sensurround effects have been included on the record, and I must admit it did not sound like any had been to me.

In conclusion, a record that will most likely appeal to a select number of listeners (or viewers). Technically, the recording was only of average quality, with quite noticeable surface noise evident in places. (D.W.E)

☆ ☆ ☆

DEEP VOICES. The Second Whale Record. Stereo, Capitol (EMI) ST-11598.

Produced by Dr Roger S. Payne and endorsed by the Project Jonah Society of Australia, this second album is also intended to further interest in the plight of whales and to earn royalties which can be used to champion their preservation. But, with over 100,000 copies sold, and still selling, that first album will be a hard act to follow.

On the new album, the whole of side 1 is taken up by recordings of the Humpback whale, in the open ocean, recorded while they were involved in a mock charge on the boat, then deep beneath a restless sea; there is a track of herd noises, and noises in the night.

On side 2 are sounds of incredibly low frequency which have been attributed to Blue whales, followed by other tracks of the "Right" species.

HiFi disc spins at 45rpm

STEREO DEMONSTRATION RECORD. Produced by "Stereo Review" magazine, USA. 45rpm. (From M. R. Acoustics, P.O. Box 110, Albion, Brisbane 4010.)

Following the title of this special stereo demonstration record comes the statement "A stunning series of demonstrations, each designed to show off one or more aspects of musical sound and its stereo reproduction". In the notes on the back, Stereo Review Music Editor James Goodfriend says that he has attempted to gather together a number of selections which will represent a wide range of musical sound, sufficient to evoke the qualities of a stereo system while, at the same time providing interesting listening for the enthusiast.

Drawing on the library of Connoisseur Society, Deutsche Grammophon Gesellschaft, Westminster Recording Company and Cambridge Records, he includes selected snippets from such works as: Festive Prelude (Strauss) — Feux d'artifice (Debussy) — Wellington's Victory (Beethoven) — Canzona XXXV a 16 (Massaino) — Concerto Comique (Corrette) — Raga Chandranandan (Khan) — Concert-Serenade for Harp and Orchestra (Rodrigo) — Gypsy Rhumba (Manitas de Plata) — Psalm XVIII (Marcello) — La Bouree (Praeterius) — Wozzek (Berg) — Sonata for Two Pianos and Percussion (Bartok).

All told, there are 13 tracks and, despite the 45rpm playing speed, actual playing time is about 37 minutes. The quality is excellent and, for an album to evaluate stereo systems, and as a technically orientated conversation piece, this would be a good choice.

A leaflet inside the jacket describes the excerpts and their musical content and suggests what to listen for. An interesting release. (W.N.W.)

In no sense intended as entertainment, in the usual sense of the term, "Deep Voices" is essentially a sound documentary that might have been made by a rather weird dairy herd but which was picked up by hydrophones from the ocean depths. You must judge whether the subject would interest you or prompt you to make an indirect contribution to the Project Jonah cause.

One tip: If you have a quadraphonic system, try it on the SQ decoder setting. You'll have whales mooing and snorting all around you! (W.N.W.)

☆ ☆ ☆

POOR BUTTERFLY. Barney Kessel & Herb Ellis. Interfusion stereo L 36313.

Care for some relaxing rhythm and blues with two guitars backed by bass and drums? Kessel and Ellis play the guitars in very polished manner. Always easy on the ears, the whole album is a low key but very pleasant experience. Recording quality is good.

There are nine tracks with a total playing time of just under 42 minutes: Dearly Beloved — Monsieur Armand — Poor Butterfly — Make Someone Happy — Early Autumn — Hello — Blueberry Hill — I'm A Lover — Brigitte. (L.D.S.)

☆ ☆ ☆

ELTON JOHN'S GREATEST HITS VOLUME II. Elton John. L 36307. Festival release.

This record will probably be snapped up by avid Elton John fans, and also by the likes of me, who has long admired Elton, but has never bought any of his records. In order, the tracks featured are as follows:— The Bitch Is Back — Pin Ball Wizard — Grow Some Funk Of Your Own — Someone Saved My Life Tonight — Benny And The Jets

THE LIGHTER SIDE

— Lucy In the Sky (With Diamonds) — Philadelphia Freedom — Country Comfort — Island Girl — Levon.

My only comments concerning the record have to do with two of the tracks. "Pinball Wizard" is from the film "Tommy", and is perhaps the highpoint of the record. "Country Comfort" has been covered by Rod Stewart, and I must admit that I preferred his version to the one included here. Technically, the record is A1, and cannot be faulted. (D.W.E.)

☆ ☆ ☆

THUNDER IN MY HEART. Leo Sayer. Chrysalis L 36344. Festival release.

Like the previous "Endless Flight" album, this offering from Leo Sayer was recorded in America, and once again Richard Perry was the producer. The result is a very professional effort, and one which shows off Leo's talents to the full.

The title track opens the album, and all the following tracks are similar in style. Leo seems to have mellowed his style since he first came to fame, and there is less of the raw energy in his voice. Still, I found the album to make pleasant listening, and would recommend it. Recording quality is excellent, with very little surface noise. (D.W.E.)

☆ ☆ ☆

20 GOLDEN GIGGLES. Various artists. Stereo (some tracks in mono). EMI. Records SOEX. 10368/D.8243.

With tracks by Benny Hill, Dudley Moore, Shag Connor and The Carrot Crunchers, Morecambe and Wise, Flanders and Swann, Spike Milligan and Peter Sellers, this album should have had me in convulsions the whole way through. However, it didn't. Admittedly, some of the tracks were good, but most of them were rather boring — a familiar problem with canned humour heard in isolation.

The best tracks were Benny Hill's "Ernie", Dudley Moore's "And The Same To You (Colonel Bogey)", Davies and Estelle's "Nagasaki", and The Wurzels' "The Combine Harvester", which is a lovely parody of a Melanie Safka song.

There are 20 tracks in all, so we don't have room to list them here. If you are contemplating purchase, I would recommend a brief sampling of most of the tracks first. Technically, the recording quality is quite good. (D.W.E.)

TURN BACK THE CLOCK

NOSTALGIC MEMORIES. 18 Songs From The World's Greatest Singers. Mono, EMI SCA016. Also on cassette TC-SCA-016.

Whether or not the soloists on this album really are the world's greatest, they were certainly amongst the best known in this country in the thirties: Anni Frind, Peter Dawson, Richard Tauber, Gladys Moncrieff, Joseph Schmidt, Jan Kiepura, Benjamino Gigli, Webster Booth, Paul Robeson, Joan Hammond, Jussi Bjorling, Marian Anderson, Gracie Fields and John McCormack.

All told, there are 18 songs with which the artists were freely associated. Without attempting to list them all, they include: Nun's Chorus — Goodbye — Vilia — Tell Me Tonight — La Paloma — Ol' Man River — Pedro The Fisherman — Softly Awakes My Heart — The Mountains of Mourne — Ave Maria, &c.

Yes, it's mono and the sound is muted, compared with modern recordings but it's relatively clean, relatively quiet and relatively well balanced — nothing to mar your nostalgic trip. And let me say it once again: the greats of that era really could sing.

If you hair is greying and your memory is long, you will enjoy this nostalgic trip as a guest of EMI Australia Ltd. (W.N.W.)

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The Australian CB SCENE

SENCORE CB42 — A COMPREHENSIVE CB TEST SET

Those who plan to take up CB servicing as a supplement to their income can exercise three apparent options in regard to test equipment: try to get by with very little; get together a variety of separate (and often inadequate) instruments; or purchase a comprehensive special purpose unit such as the Sencore CB42, as illustrated.

Despite the facilities it offers, the Sencore CB42 test set is neither bulky nor heavy. It measures 28 x 35.5 x 28cm (HWD) and weighs 10.9kg. It can operate from mains or battery.

Heart of the CB42 "DeLuxe CB Analyser" is an RF/IF signal generator designed specifically for the job. Whereas the usual test bench signal generator offers a wide frequency coverage with limited calibration accuracy, a prime requirement for a CB signal source is just the reverse: a number of specific and stable frequencies, as per the local channel allocations, with the lowest possible calibration error.

Responding to this, the Sencore CB42 uses a crystal controlled phase locked loop system, and a rotary selector switch, to make available frequencies on each of the 40 channels of the American class-D CB system. Assuming that the operator allows a 45-minute warm-up period, the oscillator can be set to an accuracy of .0001%, with a stability well inside the requirements for CB servicing. Frequencies provided for the American 40-channel system would cover 16 of the 18 Australian CB channels.

The output from the channel frequency oscillator can be amplitude modulated at either 400Hz or 1000Hz from an internal source at either 30% or 100%. Modulation from an external source is also possible. For SSB, a carrier offset of 1kHz above or below simulates a condition of 1000Hz fully modulated (USB or LSB) while a two-tone facility provides frequencies of 500 and 2400Hz.

As distinct from the crystal locked channel frequencies, the IF signal generator provides continuous coverage from 375kHz to 12MHz, with optional amplitude modulation. The frequency adjust knob is not itself calibrated but the output frequency can be displayed in the CB42's own inbuilt frequency meter, which has the same rated accuracy as the CB channel source.

RF and IF output from the CB42 is made available through a coaxial socket, at 50 ohms, the level being adjustable between the limits of 0.1uV and 100mV, as indicated by the appropriate controls. The audio signal is also available separately, via an uncalibrated level control.

The inbuilt frequency counter, read through the hooded filter at the top right of the panel, has a 7-digit display with auto-ranging, and with automatic kHz and MHz indication. Guaranteed frequency range is 50Hz to 50MHz, with up to .0001% setability, input impedance of 1 megohm or 50 ohms, and a sensitivity of 25mV (at 1 megohm) or 300mW to 25W at the lower impedance.

Back-up for the Sencore CB42 test set is thorough: maker's warranty plus a service manual for the instrument itself, a user manual, an abbreviated quick reference booklet, a general text on CB equipment servicing, and a familiarisation cassette.

Apart from reading the frequency of the generator's own source signals, the meter can be used in coniunction with internal circuitry to display the fundamental frequency of crystals plugged into a crystal test point on the front panel. The range is quoted as within 1 to 20MHz and the frequency accuracy the same as the counter itself.

The meter can, of course, be used to display the frequencies of signals fed to it from an external source at either high or low impedance. In the latter case, signals fed to the 50-ohm input can also be compared with the instrument's own channel signal and the difference displayed as "percentage off channel" within the range 0 to 1%.

The digital display system is also used for such things as a "Percent Modulation" test, an "RF Power Wattmeter" function, and an "Audio Power Wattmeter". The ratings in all cases are appropriate to D-class CB equipment: up to 20W PEP across 50 ohms RF, up to 10W audio across an internal load at 4, 8 or 16 ohms, or up to 20 watts across an external load.

There is a signal-noise sensitivity test

The Australian CB SCENE

and an in-built oscilloscope adapter which heterodynes carriers down to under 1Mhz, thereby allowing waveforms to be inspected on oscilloscopes having a relatively limited bandwidth: e.g. to 1Mhz.

The packaging and presentation of the Sencore CB42 is impressive and indicates that the manufacturers are determined that nothing will stand in the way of its successful application.

Tucked away in a storage compartment at the rear of the instrument is a group of companion test leads listed in the manual as RF cable, RF probe, counter probe, and two audio leads. These are in addition to the regular mains power cable and another for operation from 12V at 1A.

Also tucked away in this compartment is a dynamic microphone tester, which carries a small loudspeaker and a sponge pad against which the microphone can be held.

Literature supplied with the CB42 is notably generous and includes a circuit diagram and board layouts for the instrument to facilitate on-the-spot fault detection, should it prove to be necessary.

A separate 52-page user manual describes the instrument, its operation, controls and capabilities, and details the various test procedures which can be followed. Backing this up is a familiarisation cassette, which the newcomer can also listen to.

Presumably, the makers intention is that this detailed material be studied and then put aside in a safe place. For everyday use, a smaller "Speed Test Set-up" booklet is enclosed in the rear compartment, along with the cables, for quick consultation.

With the aid of panel and cable set-up diagrams and brief step instructions, the user is shown how to perform over twenty tests.

For example, AM receiver tests outlined include: audio output power, squelch, EIA receiver sensitivity, adjacent channel rejection, AGC and AM noise impulse (using an extra optional accessory). Equivalent tests are listed for receivers in SSB mode, while still others cover AM and SSB transmitter tests of the type mentioned earlier.

For good measure a large Howard-Sams paperback publication comes with the instrument, giving the purchaser an overall introduction to the servicing of CB equipment at a professional level. While aimed specifically at the American market, much of the information would be applicable in Australia.

Recommended retail price for the CB42, complete with cables, manuals and cassette is $1490. For further information, inquire at any Dick Smith store.

ADD A BALUN TO CUT DOWN TVI*

Much of the entertainment equipment used in the home is susceptible to interference from nearby CB rigs. The most annoying is interference to TV reception. In the case of CB, which uses vertically polarised signals, the interference mostly gets into the TV via the antenna down-lead.

There are various types of filters designed to attenuate the unwanted CB signal but, especially in the case of the modern transistorised TV, they are rarely effective in completely eliminating the interference. A cheap and simple solution to the problem is described below.

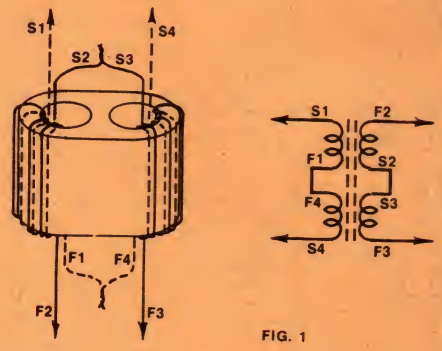

FIG. 1

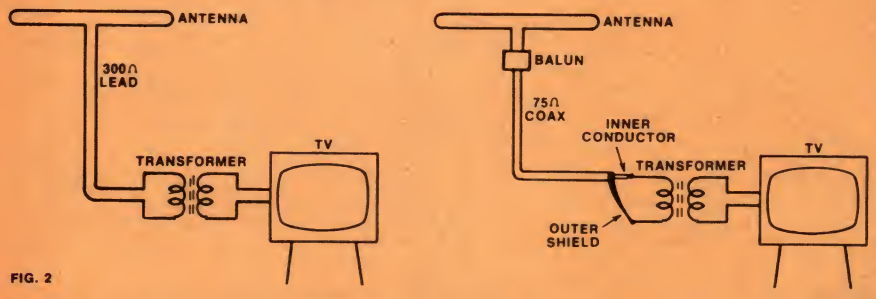

FIG. 2

Obtain a Balun core of the type used in TV antenna installations: this is a piece of ferrite material about 10 x 10 x 5mm, moulded with two holes through the centre.

Take two pieces of very thin PVC covered hook-up wire, preferably of different colour and wind them, side by side, four times through one of the holes. Technically, this would be described as a 3½-turn bifilar winding. This done, wind two more pieces of wire in similar fashion through the other hole.

There should now be four pieces of wire at each end of the ferrite. At each end of the ferrite connect two of the leads together, to form two centre-tapped windings. You will now have a 1 to 1 transformer, as illustrated in Fig. 1.

Next thing to do is to completely disconnect the TV feeder from the set. It is most important that there be no direct connection whatever between the TV set and the antenna lead, not even the outer earth shield in the case of a coaxial installation; refer to Fig. 2.

There are at least two good reasons for the success of this device. Firstly, many TV tuners do not have truly balanced inputs, although they are connected to a balanced feeder. This means that unequal currents will flow in the feeder, and there will not be effective cancellation of the interference picked up by the feeder. Some tuners will be swamped if these circulating currents are large, causing gross cross modulation.

Secondly, the Balun material sold by Dick Smith, (Catalogue 1050/2/529) L13-40 has a useable frequency range from 40-200Mhz and, coupled with the small number of turns makes a very good transformer for TV but a very bad one for CB frequencies.

(Editor's note: With no DC path to earth through the feedline, it may be necessary to earth the antenna support mast to bleed off static charges).

*From Brian J. Warman, VK5BI, Cowell 5602 SA.

CONVENTIONAL FILTERS

Conventional filters available from Dick Smith Electronics include the TVI-30 low-pass (above) intended to be fitted to the actual CB transceiver. (No. D 7082, $10.50). At right is a high-pass filter intended for fitting to the TV set. (No. D 7084, $2.50).

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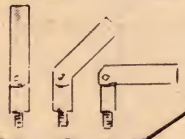

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WATCH THAT LICENSE: TVI COULD LOSE IT FOR YOU . . .

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Stop your own rig causing interference. Lo-pass filter goes on CB to cut out TVI causing harmonics. Value! Cat D-7082
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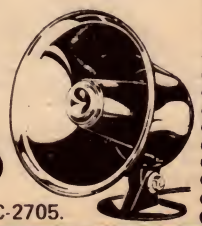

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The Australian CB SCENE

*Spectrum anarchy or conservation?

In recent years the advent of personal communications and the massive increase in radio services catering not only for commercial, but for hobby needs, has created a virtual state of anarchy, as far as spectrum usage is concerned, with almost no effective supervision of radio frequency users.

The relative ease with which radio communication equipment can be purchased, with only a token indication that its possession and use is deemed illegal, has made users and authorities alike somewhat blase about controls and utilisation.

In highlighting what appears to be a growing tendency for services of all kinds to develop in various parts of the HF and VHF spectrum, it is important to realise the potential dangers that can erupt if effective controls are not imposed on users, importers and retailers of transmitting equipment.

The problem has been compounded in recent months with the emergence of the citizens radio service. Historically the citizens radio service achieved recognition by being able to "squat" on a band of frequencies used for CB in other parts of the world (notably the USA).

Initially, the ease with which the equipment could be imported and sold, together with the comparative inability of the Government to police users, led to many thousands of transceivers being imported into this country, and used illegally, thus forcing the position. But it has not ended there:

Despite the fact that the service has been designated as a short range communications medium, the actual position is that the strong hobby interest in long distance communications has now come to mean that "short range" is considered nothing less than 100 kilometres!

In making this point, it is believed that the same degree of laxity that made possible the CB type invasion of 27MHz is present in other areas and on other frequencies. No doubt, examples of this are known to the Department and some offenders are caught, but we wonder whether the true number of infringers has ever been estimated!

We are aware, for example, of an organisation established in the USA called "HF International"; it is understood that members of this group operate in Australia, "squatting" on whatever frequency they happen to fancy.

The overall problem resolves itself, therefore, into two main areas of concern: Firstly, individuals who illegally use frequencies for their own requirements, as and when they feel inclined. Secondly, individuals rather less balanced than normal who initiate hoax calls on emergency channels and occasionally on frequencies associated with police services, air traffic control, &c. Beyond their nuisance value, they present potential dangers to both the user and the public alike.

The responsibility for ensuring effective control of the spectrum, transmitting equipment and the licensing of users, lies in several areas.

The Government, through the Postal and Telecommunications Department, has a responsibility not only to draft

* This is a precis of a submission to the P&T Dept by Russell J. Kelly and Peter D. Williams of Vicom International Pty Ltd.

DICK SMITH'S AUSTRALIAN CB RADIO HANDBOOK. Edited by Al Ferguson, illustrations by Tony Gilham. Published 1977 by Horwitz Publications, Cammeray, NSW. Stiff paper covers, 214mm x 140mm, 122pp, illustrated by sketches and photographs. Price in Australia $3.95.

Having pranced around on a motorised pogo stick, sponsored flights to the South Pole and searched for Lasseter's Reef, it was more or less inevitable that, one day, Dick Smith would turn author and publisher. And also inevitable that the subject should be CB radio.

In line with the introduction, the Dick Smith/Al Ferguson combination is not unduly concerned with the electronic technicalities of the subject. The book opens with a couple of chapters explaining what CB radio is all about and how Australian CB differs from that in the USA. Then follow chapters on choosing and installing CB rigs and antennas, mobile and base.

From chapter 6, the emphasis switches to using CB: range, rules and rituals; lingo and licences. Technicalities are not completely overlooked: 2 pages on troubleshooting and one-and-a-bit on radio theory!

That quip aside, the authors certainly achieve what they set out to do: to put the reader into the CB picture.

We are advised that copies are available through all Dick Smith stores and dealers and that booksellers and newsagents will also be handling it in the near future. Our review copy came from the DSE organisation at Artarmon, NSW. (W.N.W.)

The Australian CB SCENE

regulations but also to ensure that they are enforced.

It is understood that the current Wireless Telegraphy Act and Regulations are to be amended in 1978, making it completely unambiguous that possession of transmitting equipment is an indictable offence. It is also believed that re-wording of this particular regulation will remove any doubt as to the effectiveness of the current regulations on the same question.

It is pointed out, however, that the best intentions of policing the illegal use of transmitting equipment are worth nothing unless supported by an active team of surveillance experts with the necessary equipment to constantly monitor, track down and apprehend offenders.

It is also believed that an active campaign on the part of the Government to publicise the need for spectrum conservation may dissuade some would-be transgressors from taking the first step.

Some control will obviously be necessary over the sale of equipment. Transceivers could be imported under security, or only by qualified importers. However, these drastic measures would not be necessary if it were possible to licence retailers at the point of sale, in much the same way as control is exercised over the sale of many firearms. In other words, there could be penalties for illegal selling, as well as illegal possession.

It would also be necessary to cover the second-hand disposal of transmitting equipment, with appropriate safeguards being a condition of the original licence. At present, surplus equipment can be freely advertised and sold to anyone who wishes to purchase it.

We also believe that spectrum conservation should include recognition of spectrum pollution by any man-made interference source.

NEWS, NOTES & PRODUCTS

BLACK NIGHT CB: Imports of citizen's band radios are being challenged by an Australian development using easily-replaceable integrated circuit modules. The advanced technology means that componentry and labor content in each set is reduced by about 50 percent.

The strong Australian-made move into the booming CB market is the result of co-operation between a Sydney company and the components division of Plessey Australia. Cadet Research Pty Ltd, Annandale, NSW, is manufacturing and marketing 1000 Black Night module sets a month to sell at $350.

Cadet — which stands for communication analog digital electronics technology — is confident that the 12-watt PEP (peak envelope power) single side band radio will perform better and be more easily maintained than many more costly imported competitors.

The light-weight sets are built around 11 recently-

The Australian CB SCENE

Another entry by Bill Chambers. (See below).

designed test-proven Plessey integrated circuits and frequency synthesisers in removable modules for on-spot replacement in the event of malfunction and a microprocessor unit for channel selection and memory. CREST HEADQUARTERS: Since the legalisation of CB radio (known in Australia as the Citizens Radio Service — CRS) there has been an enormous growth in the number of people taking advantage of it, There has been enormous growth, too, in the activities of CREST — Citizens Radio Emergency Service Teams — using 27.065MHz, (ch 9 in the 23 ch system, ch 5 in the Australian 18 ch system). Now CREST moves into a new operating phase, having acquired space in Northpoint Towers, at 100 Miller St, North Sydney, where a 24-hour monitoring facility will be established. Coverage should extend south to Wollongong, west to the mountains and north to Gosford.

CB Cartoon Contest winner

As announced in our December issue, the Dick Smith CB cartoon contest was won by Mr William Chambers of Hobartville, NSW. Subsequently, "Bill" called into our office to pick up his prize: a Hy-Gain 23-channel SSB/AM transceiver. Aged 23, married with two children, he is a fitter with the RAAF at the Richmond, NSW, air base, but is currently retraining as a dental mechanic. He combines these activities with an interest in electronics — and in cartooning!

AMATEUR RADIO

by Pierce Healy, VK2APQ

Conventions, field days, and coming events

Conventions, field days, get-togethers, call them what you will, have the same meaning to amateurs world-wide — an opportunity to meet socially and talk about their common interest; radio communication and their achievements in that sphere.

Whether it be contacts made, equipment used, propagation conditions, illegal use of amateur bands, restrictions imposed by administrations or whatever your particular foible may be, there are always sympathetic ears to be found at such gatherings. The competitive events cater for individual or team participation.

In short, to attend one of these events is to enjoy the fellowship for which amateur radio is noted.

Here are details of several such events; some to be held in the immediate future and some held in the recent past.

GOSFORD FIELD DAY

All amateurs, their families, friends, and all interested in amateur radio are invited to attend the CCARC field day at the showground, Showground Road, Gosford, on Sunday, February 19, 1978. A full program has been organised.

8.00-9.00am: Registration, fees — Men $4; ladies $2; children 16 years and under $1.

Special note: Lunch will not be provided by the club, but a take-away food bar will be open in the showground. Morning and afternoon tea continuously available. You may bring your own picnic lunch, tea or coffee provided free to all who register.

8.30-9.30am: Mobile scramble in two sections. (a) HF, (b) VHF. No operation in showground or 1km radius. VHF net frequencies, 1 point per contact. VHF tunable CW AM or SSB, 4 points per contact. Log extract must be handed to event recorder before 10am showing time, station worked, frequency, mode, serial numbers exchanged and points claimed.

9.00am: Registration for talk-in fox hunt.

Note: Items for disposal sale must be passed in before 9.30am.

9.30-10.15am: 2-metre fox hunt on 146MHz, sniffer required.

10.00am and 10.15am: Junior 2-metre AM pedestrian fox hunts, 144.4 to 144.6MHz.

10.00am: Disposals open for inspection and sales.

10.00-11.30am: Children's events.

11.00am: 2-metre AM pedestrian fox hunt (144.4-144.6MHz). Quiz sheets available. To be returned before 1.30pm. Neatness will count in the event of a tie. Divisional broadcast from VK2AFY. Broadcast will be televised to showground.

11.20am and 11.50am: 2-metre AM pedestrian fox hunt (144.4-144.6MHz).

12 noon-1.00pm: Lunch break — see note above.

1.00pm: Registration for talk-in fox hunt closes. Drawing of lucky numbers — numbers must be claimed before 1.15pm otherwise a redraw will be made.

Before 1.30pm: Completed quiz sheets must be handed in.

1.30pm: Group departure for reptile park outing (private cars). Tickets available at time of departure.
Bus leaves for tour of central coast — return at 4.00pm. Tickets available at "name tags".

1.30pm: Talk-in fox hunt on channel 3 repeater. Two sections — licensees only; listeners only.

2.00-2.15pm: Junior 2-metre AM pedestrian fox hunts (144.4-144.6MHz).

2.30-3.40pm: 2-metre fox hunt 146.00MHz. Sniffer required.

4.15pm: Presentation of prizes.

Other attractions: Ladies stall; Artex display; lucky door prize; disposal store; amateur television; trade displays; children's hoopla.

Parking: In showground.

Trains: From Newcastle 9.07am; from Sydney 8.58am and 9.52am. Will be met and transport provided from Gosford station. For return transport contact announcer at showground.

The field day will be held irrespective of weather conditions, there is plenty of shelter at the showground.

Bring your QSL card for the calls present board.

Cataloguing and lot numbers for disposal equipment must be obtained prior to the field day. Contact Bill Smith, VK2TS, RMB 4525 Gosford 2250 or telephone 043 74 1207 for forms and lot numbers. A commission will be charged on all sales. Companies or groups wishing to set up displays, etc, should contact the CCARC, PO Box 238 Gosford 2250 in advance.

This is the largest field day in Australia. Come meet old friends and make new ones.

URUNGA CONVENTION: Held each year over the Easter holiday weekend, this event attracts amateurs from Queensland, New South Wales and those holidaying along the coast.

This event originated 30 years ago, when amateur friends of the late Crieff Retallick, then VK2XO, gathered for a spot of fishing, over Easter, at Crieff's fishing shack near the mouth of the Bellingen River.

After a few years the number of amateurs increased and it was necessary to use the small country hotel. Eventually local residents provided guest house facilities to those unable to gain hotel accommodation. There is now a motel and caravan park, plus a golf club and bowling club where amateurs are made extremely welcome.

It has been said in the area that the Urunga amateur radio convention really put the township in the public eye and contributed to its growth. The hotel, motel and other businesses in the area donate worthwhile prizes to the convention.

Ron Petrick, VK2CZ, convention publicity officer, advises that the "do" will be on again over Easter 1978 (24th, 25th, 26th and 27th March), and extends an invitation to all amateurs to attend.

Program details in next month's notes.

Ron may be contacted on telephone (02) 449 3112 for accommodation details.

NZART ANNUAL CONVENTION: The New Zealand Association of Radio Transmitters will hold their annual convention at Napier, NZ, over the weekend 3rd, 4th and 5th June, 1978 (Queen's Birthday public holiday in

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the names you look for in advanced amateur communication equipment.

Would you buy a "Rolls" at your Supermarket?

. . . then why buy your first class radio equipment that way?

Bail Electronic Services have been the Australian factory representatives and specialists in Yaesu amateur communication equipment since 1963.

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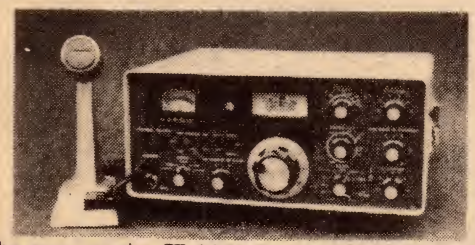
A selection of the top lines from Yaesu and Bail

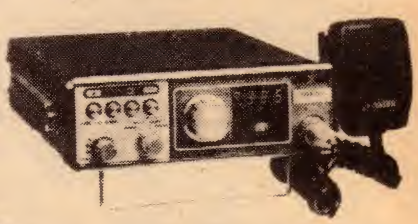


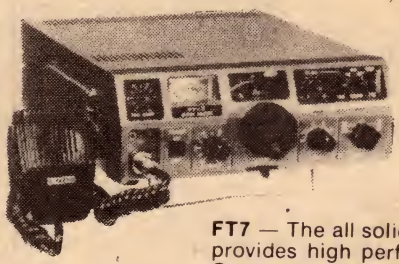
The ever-popular FT-101E Transceiver. 160-10 Mx SSB AM CW PA two x 6JS6C 260W PEP input SSB Built-in Dual AC/DC power supply.
BUILT-IN RF SPEECH PROCESSOR. Solid state except for Tx. PA and driver. IF noise blanker, FET RxRF amplifier, clarifier, built-in speaker. Export Mod 240V AC 12V DC.

FT901DM, the ham's dream, a deluxe 160-10m Tcvr with a host of new unusual features placing it far ahead of other sets. P.A.2x6146B, Dig. and analogue readout, Freq. memory, electronic keyer, AC/DC operation, RF speech processor, variable I.F. band width, special circuitry to reduce spurious and harmonic emissions, etc!
(Not illustrated)

New releases for 1978 —

FT-277R. Latest in VHF FM, just released 800 ch 2M band FT-277R with memory, Dig. readout, unique optical band change eliminates troublesome switch controls. ± rptr facility, etc.





FT7 — The all solid state FT7 20w, 12V mobile tcvr provides high performance on the 80-10m bands. Compact and lightweight, it supersedes the successful FT75B and includes built-in VFO, provision for CC operation, single knob tuning, NB, plus many more desirable features. Ideal for novice and O.T.

Contact us for details of other Yaesu equipment plus the accessories required to complete your station.
All equipment from Bail's carries a 90-day warranty and complete service back-up.

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W.A.	Radio Communication Services H. R. PRIDE, 26 Lockhart St., Como, 6152	Ph 450 4379
	WILLIS TRADING CO., 429 Murray Street Perth 6000	Ph 21 7609
S.A.	FARMERS RADIO PTY. LTD., 20 Stanley St., Plympton, 5038	Ph 293 2155
TAS.	G. T. ELECTRONICS, 131 Westbury Rd., South Launceston, 7200	Ph 44 4773
	PRINS RADIO, 123 Argyle Street, Hobart 7000	Ph 34 6912
N.S.W.	Aviation Tooling, STEPHEN KUHL, 104 Robey St., Mascot, 2020	Ph 667 1650 AH 371 5445
	Amateur & Novice Comm. Supplies, W. E. BRODIE, 23 Dalray Street, Seven Hills, 2147	Ph 624 2691
	DIGITRONICS, 186 Parry St., Newcastle West, 2302	Ph. 69 2040
QLD.	H. C. BARLOW, 92 Charles St., Aitkenvale, Townsville, 4814	Ph 79 8179
	MITCHELL RADIO CO., 59 Albion Rd., Albion, 4010	Ph 57 6830
A.C.T.	QUICKTRONIC, Jim Bland, Shop 11, Altree Crt., Phillip, 2606	Ph 81 2824 82 2864

AMATEUR RADIO

NZ). Overseas visitors will be particularly welcome.

Registrations for accommodation at Napier should be made before 22nd March, 1978 and should be sent to NZART Convention Committee, PO Box 4030, Napier, NZ.

Stan White, ZL2AHC, convention publicity officer, will be pleased to give details of activities planned. More details in later notes.

RADIO FIELD DAY AT BCCC: Peter Richards, recreation officer at the Blind Citizens' Community Centre, 454 Glenferrie Road, Kooyong, Victoria, reports on a field day at the Centre on Sunday, 4th December, 1977.

The field day was held to demonstrate a number of aspects of amateur radio, with special emphasis on the potential this activity has for people with a sight disability.

Several pieces of equipment were available for people to handle and examine. Some of the equipment included:

- two general coverage HF transceivers;
- VHF equipment covering the 2-metre band for local communication;
- exhibits of general radio components;
- a talking calculator, modified to work in conjunction with a digital voltmeter;
- demonstration of aerials;
- all band communication receiver;
- Morse code equipment with automatic dot memory.

A number of amateurs helped to make the day a success and sincere thanks were expressed to them. Included were: Rob Faravonie, VK3ANI; Bob Byers, VK3BHF (who is totally blind); Dr Gerald Ungar, VK3AOU; Bob Young, VK3BIC; Bill Mudie, VK3XS; Graham Scott, VK3XR; David Ditchfield, VK3YSK and Collin Pomory, VK3BLE.

It is hoped this field day will be the fore-runner of other such activities, and possibly a club which can assist visually handicapped people to become more involved in the hobby.

Further details from Peter Richards or David Ditchfield at the Association for the Blind, Kooyong, Vic. Telephone (03) 20 8701.

QCWA XMAS PARTY: The Sydney Chapter-Quarter Century Wireless Association members held their Christmas dinner party in the Elizabeth Room, ANZAC Memorial Club, North Sydney, on Thursday evening, 15th December, 1977.

Fifty-one persons, including members, their wives and guests, gathered for pre-dinner drinks and a very tasty dinner.

A welcome to the ladies and guests was extended on behalf of members by president Wal Webster, VK2EW, who introduced Lionel Swain, VK2CS, as toastmaster for the evening. Toasts were proposed to the QCWA by Frank Leverrier, VK2ADE, and to the ladies by Sel Weston, VK2SY.

Golden anniversary certificates were presented to Bert Hay, VK2AE, and Roy Hart, VK2HO, by the president. These certificates are in recognition of having being an amateur operator for 50 years or more.

Secretary Harry Caldecott, VK2DA, played a tape expressing best wishes for the festive season from Maurie Brown, VK2OR/G2YP, to those attending the dinner.

It was estimated that there was around 1000 years of amateur radio experience among the amateurs attending the dinner.

RARE DX CONTACT

Steve Hamilton, VK3BIZ/3OT, of Hamilton, Victoria, has received a much valued QSL card from UA0CCW. The card confirms the first 6-metre contact between Australia and the USSR (VK-UA).

The contact was unique in that 6-metre band operation is not permitted to amateurs in Region 1. The station was an experimental one set up by the radio club in Khabarorsk, eastern USSR, about 650km north-east of Vladivostok, in 1976.

Other VHF Region 1 achievements reported by Steve are — USSR-Japan and Korea (UA-JA/HL) on 6 and 2 metres and Alaska-USSR (KL7-UA) on 2 metres.

Steve offers a QSL service to Australian stations who contact VK9NI and YJ8KM, providing a SAE is sent. The address for this service is PO Box ZZ, Hamilton, Victoria 3300.

WIRELESS INSTITUTE NEWS

In a letter dated 23rd November, 1977, received by the WIA federal office, the Radio Frequency Management Branch advises that approval has been obtained for any novice licensee who was disadvantaged by the withdrawal of the 26.96 to 27.23MHz band, resulting in the need to purchase new equipment or to have existing units modified, and who desires to participate in the Citizens Radio Service, to be granted a special licence to cover both the novice service and the CRS.

The annual licence fee will be $25 — i.e. the normal rate for a CRS station licence. Applications should be made to the officers of the State Superintendents, Radio Branch.

WARC FUND: The WIA executive have expressed their grateful thanks for the early donations received during 1977 towards the WARC 79 fund.

P&T EXAMINATIONS: A meeting of instructors from several states called by Graeme Scott, VK3ZR, federal education officer, was held in Melbourne on 7th December, 1977.

The meeting discussed the standard of questions in the recent novice exam and the continued lack of any syllabus or study guides. Several aspects of WIA educational facilities were also discussed.

A protest was lodged with the secretary of the P&T Department concerning the standard of the October 1977 novice theory examination. The Department was requested to re-examine the percentage marking of the papers to admit passes at levels lower than 70%, having regard to the questions which were deemed to be closer to AOCP than novice standards.

RADIO CLUB NEWS

LIVERPOOL & DISTRICTS AMATEUR RADIO CLUB: Because of the club's growth the meeting place has been moved to the Liverpool Public School, Bigge Street, Liverpool, opposite the Liverpool Railway Station.

Lectures for the novice licence are given each Tuesday evening at 7.30pm. The first meeting of the club in 1978 will be on 14th February. YRS classes are held each Saturday at 10.00am, the 1978 classes commence on the 11th February.

The club also conducts Morse practise sessions each Monday night on 146.5MHz commencing at 7.30pm. Also available for Sydney residents, is a Morse practise tape hire service. An HF net is held at 6.30pm on 28.52MHz USB and at 8.30pm a VHF net on 146.5MHz FM each Monday evening. The club call sign is VK2AZD.

Any enquiries about the LDARC should be directed to Nev Fenton, VK2ZBQ on telephone (02) 607 6261.

MOORABBIN & DISTRICT RADIO CLUB: Having gained third place in the 1977 John Moyle Memorial Field Day, members are aiming for top position in the 1978 event on the third weekend in February.

At the 1977 annual general meeting in November, the office bearers elected were: President, John Kerr, VK3BAF; Vice-President, John Kerr, VK3BJF; Secretary, Glen Percy, VK3ZQP; Treasurer, Jim McCardle, VK3ZOE; Committee, Morrie Lyons, VK3BCC, Chris Thomas, VK3N??, Eric Buggee, VK3ZZN; Combined Clubs Committee: Jim McCardle, Adrian Mensford, Murray Felstead.

GRIFFITH RADIO CLUB: Four out of six members who were candidates at the November novice exam were successful. It was also reported that, at the end of December, 1977, four candidates for the August, 1977 AOCP exam had not received their results.

Warwick Marshallsea, VK2ADZ, and Ted Druitt, VK2AXD, represented the club at a meeting at Young on the 26th November, 1977, to discuss WIA and NSW divisional policy matters with council representatives and country amateurs.

Plans are being made to produce a

AMATEUR RADIO

monthly news bulletin on GRC activities.

The South West Zone Net is held at 8.00pm each Wednesday on 3545kHz.

WESTLAKES RADIO CLUB: The growth of the WRC has made it necessary to consider enlarging the club premises in York Street, Teralba. Tentative arrangements have been made to purchase a 5.5 metre by 21 metre building for resiting as an extension to the present building. It is estimated to cost about $3000.

Membership now stands at 270. Saturday afternoon classes will recommence on the 11th February, 1978.

GEELONG AMATEUR RADIO & TV CLUB: It was reported in the November 1977 issue of the GARC newsletter that the tower, rotator and HF beam had been installed at the club rooms, but that vandals had severed the coaxial feeder and rotator control wires.

It was also announced that the third novice licence course would commence in February 1978. For immediate information visit the club in Storrer Street, East Geelong, on a Friday evening.

AUSTRALIAN CLUB DIRECTORY

Club name: Benalla District Radio Club.
Club call sign: Nil.
Meeting place: Benalla High School.
Day and time: First Friday of each month at 8.00pm.
Affiliation: WIA Victorian Division.
Net frequency: Nil.
Contact: John Whitehead, VK3BLK, Main Street, Goorambat, Vic. 3725 or Rodney Johnstone, VK3NET, 94 Thomas Street, Benalla, Vic 3672.

Club name: Eastern and Mountain District Radio Club.
Club call sign: VK3ER and VK3BNW.
Meeting place: General meetings in the Willis Room of the Library. Branch meetings in the Coffee Shop, Nunawading Civic Centre, Maroondah Highway, Nunawading.
Day and time: General meeting first Friday of each month and Branch meeting on fourth Friday of each month commencing at 8.00pm.
Affiliation: Victorian Division WIA.
Net frequency: 3660kHz each Monday evening at 8.00pm.
Contact: Secretary Bill Rose, VK3ZMI, PO Box 87, Mitcham, Vic 3132. Telephone (03) 725 6642.

Club name: Eastern Zone WIA Victorian Division.
Club call sign: Repeaters VK3RLV and VK3REG.
Meeting place: Gippsland Institute of

AMATEUR RADIO

Higher Education, Churchill, Victoria.
Day and time: Last Friday of every third month (commencing January) at 7.30pm.
Affiliation: Victorian Division WIA.
Net frequency: Channel 4 repeater VK3RLV; FM simplex channel 40 and 3572kHz Wednesday evenings.
Contact: R. Price, VK3AWQ, 5 St Kilda Street, Inverloch, Vic 3996. Telephone (056) 74 1351.

Club name: Frankston & Mornington Peninsula Amateur Radio Club.
Club call sign: VK3BHU.
Meeting place: Monterey Technical School, Silvertop Crescent, North Frankston.
Day and time: Second and fourth Friday in the month at 8pm.
Affiliation: WIA VK3 Division.
Net frequency: 3885MHz — 1000 hours GMT Wednesday, VHF club frequency 145.4MHz.
Contact: Secretary, FAMPARC, PO Box 38, Frankston 3199.

WIRELESS INSTITUTE ADDRESSES

Wireless Institute of Australia — Federal Executive, PO Box 150, Toorak, Melbourne, Victoria 3142.

Australian Capital Territory Division — PO Box 1173, Canberra City, ACT 2601.

New South Wales Division — Wireless Institute Centre, 14 Atchison Street, Crows Nest, NSW 2065.

Victorian Division — 412 Brunswick Street, Fitzroy, Vic 3062.

Queensland Division — GPO Box 638, Brisbane 4001.

South Australian Division — GPO Box 1234K, Adelaide 5001.

Western Australia Division — GPO Box N 1002, Perth WA 6001.

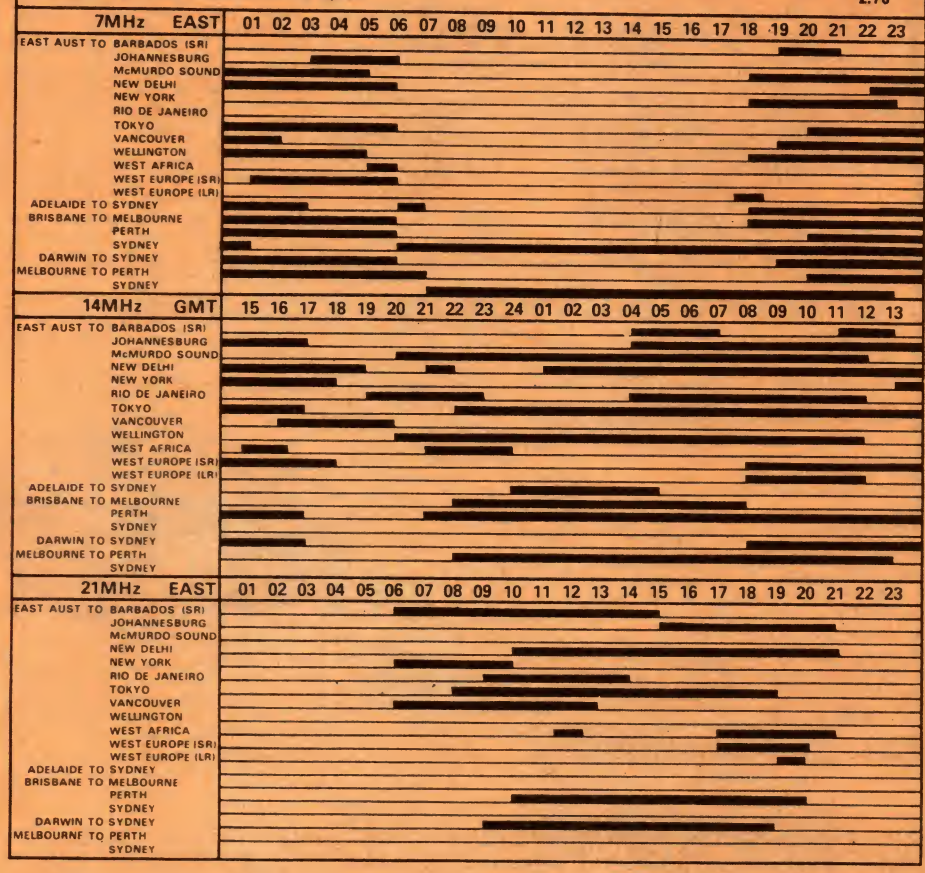
Tasmanian Division — GPO Box 869J, Hobart, Tas 7001.

Club name: Geelong Amateur Radio & TV Club.
Club call sign: VK3ATL and repeater VK3RGL.
Meeting place: Club Rooms, Storrer Street, East Geelong.
Day and time: Each Friday night at 8.00pm.
Affiliation: Victorian Division WIA.
Net frequency: Channel 8 repeater VK3RGL.
Contact: Secretary, PO Box 520, Geelong, Vic 3220, or Alan Bradley, VK3LW, telephone (052) 43 7550.

Club name: Ladies Amateur Radio Association.
Club call sign: None.
Meeting place: As arranged to suit members.

IONOSPHERIC PREDICTIONS FOR FEBRUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 2.78



Day and time: Saturday afternoon once a month in Melbourne, as arranged to suit members in other states.
Affiliation: Wireless Institute of Australia.
Net frequency: 3650kHz each Monday evening at 8.00pm EST.
Contact: LARA, C/- 412 Brunswick Street, Fitzroy, Vic 3065.

Club name: Moorabbin & District Radio Club.
Club call sign: VK3APC.
Meeting place: Combined Clubs Hall, Turner Road, Highett, Vic.
Day and time: First Friday of month — Natter night at 8.00pm. Second Friday of month — 144MHz hidden transmitter hunt, commencing at 8.00pm. Third Friday of month — General meeting at 8.00pm.
Affiliation: WIA Victorian Division.
Net frequency: Not stated.
Contact: Secretary, PO Box 88, East Bentleigh 3165.

Club name: Warrnambool Amateur Radio Club.
Club call sign: VK3BHD.
Meeting place: Warrnambool Buffalo Lodge Rooms, Cnr Kariot and Kelp Streets, Warrnambool.
Day and time: First and third Wednesday of each month at 8.00pm.
Affiliation: WIA Victorian Division.
Net frequency: Nil.
Contact: Ian Mason, PO Box 10, Yambuk, Vic 3285.

Club name: Western Suburbs Radio Club.
Club call sign: VK3AWS.
Meeting place: Melbourne Caravan Park, 265 Elizabeth Street, East Coburg, Vic.
Day and time: First Friday of each month (except January), at 8.00pm.
Affiliation: Not stated.
Net frequency: FM channel 53.
Contact: Secretary, Reg Lloyd, 171 Cheddar Road, Keon Park, Vic 3073.

Sunspot cycle 21 coming up....

Sunspot cycle #21 in now on the up-and-up! Share in some of the fun on 6 metres DX with the **ICOM IC502** ssb portable transceiver. The IC502 covers 52-53MHz with VFO control, RIT, effective noiser blanker, provision for external power and antenna and comes complete with carrystrap, mic and English handbook. Backed by **VICOM** 90 day warranty. Price **$219**

HELLO 6M DX
IDEAL FOR SATELLITE WORKING

The **IC202** is the ideal 2m exciter for those long-haul DX contacts or to work oscar. 3watts ssb and cw, VXO control, quality manufacture and comes complete with manual, carry-strap, mic and VICOM 90 day warranty. Price **$219**

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Hold it!

ICOM IC-215 2m FM transceiver $219

• 2 meter FM • 3 W PEP • 15 channels, 12 by selector, 3 by function switch • Dual power level, 3 W HI for long distance, 0.5 W LOW for local • Dial illumination for night use • Power pilot lamp • Frequency range: 146 to 148 MHz.

ACCESSORIES FOR THE PORTABLES

BC-20 nicad pack and reg.	$57
Rubber Ducky 2m antennas	$13
Mobile mounting bracket	$18
IC3PS matching power supply	$115
IC20L 2m linear, 10w out	$98
IC50L 2m linear, 10w out	$90

QUALITY HANDY PORTABLES

WRITE FOR THE ICOM CATALOG

ICOM

COMING SOON!
The new **ICOM IC701** HF solid state transceiver. Write for details!

WARNING: The law requires that a licence be held for all transmitting equipment. Purchasers may be asked to provide evidence that he/she is the holder of an appropriate certificate of proficiency.

YAESU

FT-101E

FT101E HF transceiver 160m thru 10m	$859
FL2100B HF linear amplifier	$578
FRG-7 Receiver	$338
FT301D HF solid-state transceiver	$1149

KENWOOD

KENWOOD TS-520S transceiver

TS820S HF digital transceiver	$1105
TS520S HF 160-10m transceiver	$705
VFO820 vfo for TS820S	$115
TV502 2m transverter	
TV502 2m transverter	$260
TV506 6m transverter	$229
TR7400 2m fm digital transceiver	$450
MC50 desk mic, dynamic	$54

SPEECH PROCESSORS

MC330 audio mic compressor, ac/dc	$71
RF550 rf speech processor	$112
RF440 rf speech processor	$149

ICOM IC-22S FM transceiver

Price **$279**

The popular VC2 swr/pwr meter for ham and CB use covers 3-150MHz. Each unit is individually calibrated for the Australian ham bands plus CB, high accuracy with power measurements 12/120 watts with total capability 1000 watts. Comes complete with informative instructions. Price $38

FOR THE PROFESSIONAL
The popular Oskerblock SWR200 handles power measurement 2/20/200/2000 watts with dual impedance and good accuracy. Price $75

NOISE BRIDGES

TE7-01 Omega, up to 100MHz	$40
TE7-02 Omega, up to 300MHz	$55

BALUNS

AS-BL(Asahi) for beams	$31
BN86 (HyGain) for beams	$30
BL50A (Rak) 50 ohm, 4Kw, dipole	$25
BL70A (RAK) 70 ohm, 4Kw, dipole	$26

couplers

CL65 500w, 2.5 thru 20MHz	$134
CL99 200w, 2 metres	$61
CSW216 incl swr/pwr meter, 3.5-28MHz	$219

$849 uniden

The fabulous Uniden 2020 phase-locked-loop transceiver offers separate usb/lsb/cw 8-pole crystal filters as standard and 6146B's in the final with screen voltage stabilisation for minimum distortion products. Features plug-in pcb's and even the front panel can be swung out for easy servicing. A full spares catalogue is available together with change-over pcb's. Compare the Uniden 2020 with other HF transceivers and you'll be quickly convinced that it offers the best value!

ROTATORS

ART3000C heavy duty with control box	$199
ART8000 super heavy duty	$478
AR22XL light duty for small beams	$109

Direction: Russell J. Kelly
Peter D. Williams

swr bridges

MORSE KEYS

HK702 deluxe, marble base	$35
HK708 economy model	$19
HK706 operator's model	$20
MK701 manipulator	$38
ED103W electronic keyer	$159

MICROPHONES

VM-1 ptt lowZ, noise-cancelling	$8.90
VM-2 base with preamp, low Z	$29.80

L.P. FILTERS

FD30M 32MHz cut-off, 1KWpep max	$35
FD30LS 32MHz cut-off, 200w max	$20

Antennas!

You know you can count on

hy-gain

TH6DXX 6el 10/15/20m Thunderbird	$320
TH3MK3 3el tribander 8dB gain	$249
TH3Jr 3el tribander, 12' boom	$199

TRAP VERTICALS

V5Jr 6.7m high, 80 thru 10m, no guys	$109
V4Jr 4.25m high, 40 thru 10m, no guys	$89

TRAP DIPOLES

MidyVN 80 thru 10m	$67
AL48DXN 40 & 80 metres, 2Kw	$54

TWO METRES

ARX-2 Ringo Ranger base antenna	$49
Lindenow wave mobile whip	$26
42S ¼ wave mobile whip with cable	$14
82D mobile whip with cable	$26

Prices and specifications subject to change without notice.

VICOM

Head Office and Mail Orders:
139 AUBURN ROAD, AUBURN, Vic.
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TLX 30566
Adelaide: 43.7981 Brisbane: 38 4480
Canberra: 82.3581 Gold Coast: 32.2644
Perth: 446.3232

ICOM IC-22S 2-METRE TRANSCEIVER

Recently to hand from Vicom International was a sample of the latest Icom 2 metre mobile transceiver; the IC-22S. Using a phase locked loop synthesiser it offers the same switched channel selection as on previous IC-22 models, but with the advantage that any wanted channel can be provided for the cost of a few diodes, rather than a pair of expensive crystals.

Icom transceivers, and the Icom-22 series in particular, need little introduction to the amateur fraternity, having enjoyed an excellent reputation for many years. This model will almost certainly enhance that reputation.

This is the first synthesised model, all previous models having required a separate pair of crystals for each channel. With the increasing cost of crystals and the proliferation of channels, particularly repeaters, synthesised units, in one form or another, have become very attractive.

Synthesised systems normally take two forms; those in which the wanted frequency is "dialled up" on a digital readout, and those in which preprogrammed channels are selected directly by a multi-position switch.

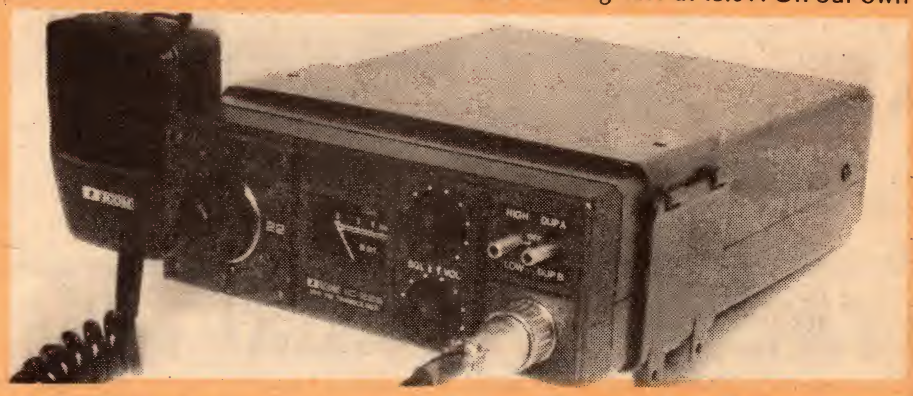
Both have points in their favour. The first system is the more versatile, normally providing a large number of channels, often with close channel spacing. On the other hand, the need to remember the exact channel frequency (as distinct from the channel number) and the job of dialling it up can prove inconvenient when mobile.

The Icom 22S uses the second system, retaining the 22 position switch and dial which were so popular on the previous model. This certainly makes for very convenient mobile operation, although at the expense of the number of channels available. Even so, not many amateurs could afford to equip all 22 positions with crystals (around $260 worth!) in the older models, so 22 channels at no cost is still a luxury.

(A number of schemes have been described in overseas journals which permit fitting simple, low-cost external programming devices and the provision of virtually as many channels as may be required. Refer "73" October 1977.)

The wanted channels are programmed by fitting diodes to a double sided printed board inside the case. One end of the board unplugs to allow it to be folded out for easier working. The number of diodes required for a particular channel varies, but would probably average four.

The diode connections for a particular channel may be derived from a suitable chart, or calculated from a simple formula. The Icom 22S manual gives a complete list of the US 2 metre channels and the appropriate diode connections, but this is of limited value in Australia, due to our 25kHz spacing as opposed to the US 15kHz spacing. Vicom International supply an additional sheet giving the formula for Australian channels.



As with all synthesised systems there is an offset switch, giving a 600kHz offset in either direction, according to whether the repeater output is above or below the input frequency.

Most synthesiser systems are designed to shift the transmitter frequency up or down as required, but the 22S uses a somewhat different system, probably in the interest of circuit simplicity. For repeaters where the output frequency is higher than the input frequency, ie, channels 1 to 8, the offset switch leaves the transmitter on the programmed frequency and increases the receiver frequency by 600kHz.

Where the output frequency is lower than the input frequency, the receiver remains on the programmed frequency and transmitter frequency is increased 600kHz.

This has the advantage of permitting "anti-repeater" operation by simply setting the offset switch to the opposite position normally required for a particular repeater.

On the other hand, leaving it in the simplex position on a repeater channel can produce a pseudo or partial "anti-repeater" mode, which may confuse.

This is mentioned merely to emphasise that all systems using an offset switch need a little more care to operate than the all-crystal variety.

As supplied by Vicom the set is already programmed for repeaters 1 to 8, plus simplex channels 40, 50, and 51. In addition there is a pack of 50 diodes enough for another 10 channels.

As an exercise we fitted some extra channels and this proved a simple enough job. However, on one channel (repeater 12) a low level spurious signal was noted, apparently a stray harmonic from one of crystals or divider chains. On-air tests suggest that it is unlikely to be a serious problem in practice.

The receiver is a double superhet — 10.7MHz and 455kHz — and the specifications claim a sensitivity of 0.4uV, 30dB or better S+N/N at 1uV, and a squelch sensitivity of 8dB below 1uV (0.4uV). Selectivity is given as —6dB at 7.5kHz and —60dB at 15kHz.

The transmitter is rated at 10W or 1W, deviation 5kHz, and spurious signals at least —60dB. The unit we received had been checked by the Vicom laboratory as delivering 12W at 13.8V. On our own dummy load it delivered only marginally less than this on 13.5V.

The unit is similar in size to the previous models; 58mm (H) x 156mm (W) x 218mm (D) and weighs 1.9kg. The receiver draws 700mA at maximum output (1.5W) and 400mA squelched. The transmitter draws 2A at 10W and 0.9A at 1W. It is suitable for use on negative chassis electrical systems only.

While it was not practical to measure all the specifications, the set was given a thorough workout under typical amateur conditions, both mobile and as a base. Nothing in its performance gave us any reason to question any of the specifications and, in fact, it behaved well in all respects.

All the on-air reports — without the type of set being made known — were favourable with the audio quality being particularly mentioned.

In short, a very satisfying unit which, by reason of its versatility, should satisfy the average amateur's needs for a long time. And at the current price ($279) it represents very good value.

Further details may be obtained from Vicom International Pty Ltd, 139 Auburn Rd, Auburn, Victoria, 3123. (PGW)

SHORTWAVE SCENE

by Arthur Cushen, MBE

Cameroons' new 100kW transmitters

Cameroons is the latest country to operate an External Service. Broadcasts in English and French have been heard from Yaounde over the 100kW transmitters.

The introduction of three 100kW transmitters by Radio Cameroons at Yaounde has resulted in their reception on several new frequencies. The transmissions on 9745kHz have been observed around 0600GMT. At this time there is a news bulletin in French and at 0610GMT a ten minute news service in English, followed by light orchestral music. The frequency is blocked at 0700GMT by HCJB in Quito, Ecuador.

Reception during our mornings has been noted, with music heard at 2030 and the interval signal and an announcement in French at 2100GMT. Interference from Radio Moscow with an English transmission to Africa has occured during the period of reception.

The BBC Monitoring Service reports that the External Service is also heard on 4850kHz at 1650GMT. At 1700GMT, the station announcement was given and the program is called "Mixed Grill". The station is keen to receive reception reports sent to "Mixed Grill", External Service, Radio Cameroons, Yaounde, Cameroons.

LEBANON RETURNS

Radio Beirut recently returned to short-wave broadcasting after the internal war in the country which put the short-wave service out of action in June 1976. The station has resumed transmission using the same schedule as in the past, and we have been hearing the English broadcasts directed to West Africa on 11755kHz 1830-1900GMT. This frequency provides fair reception, though there is some co-channel interference.

According to the station announcement, they broadcast to West Africa 1830-2030GMT and to South America 2300-0030GMT on 11755kHz, and to North America 0130-0300GMT on 9680kHz. The transmission to North America includes English 0230-0300GMT.

PARIS CALLING AFRICA

Radio France International is using several transmitters in its broadcasts to Africa in English 1700-1800GMT. Broadcasts to West Africa are beamed on 11890, 11930, 15360 and 15425kHz; to Central and South Africa on 11705 and 15300kHz; to East Africa on 9605, 11860, 11965, and 15210kHz; and to North Africa on 11705, 11890 and 11930kHz. The station is keen to receive reception reports, which should be sent to Radio France International, PO Box 9516, Paris France.

This is the only English transmission heard from Paris. All other transmissions are in French or other European languages.

TWR GUAM

Trans World Radio at Agana, Guam, is operating to a new schedule up to March 5. This includes the use of two frequencies in the 16 metre band which have been providing excellent reception in New Zealand during the morning transmission.

The present schedule is from 2100GMT on 11705kHz; 2200GMT on 11705 and 15175kHz; and 0000-0130GMT on 17830 and 17855kHz. English broadcasts for our evening reception are 0915-0930GMT on 9640kHz, 1000-1100GMT on 15115 and 9640kHz, and 1330-1500GMT on 9760 and 11705kHz.

The station has expressed its appreciation for the help received from listeners in Australia and New Zealand according to "New Zealand DX Times" and "Australian Radio DX News". Listeners reports have helped them to evaluate their service to this area and make frequency changes to enable us to enjoy better reception.

RECENT VERIFICATIONS

SURINAM: A verification card has been received by Douglas Johns of Christchurch, NZ, one of the first to report confirmation of reception of Surinam on 4780kHz. The verification is a multi-coloured card and, according to the station, over 600 reception reports have been received since they commenced operation on short-wave in March 1977. The power is 1kW, but plans are underway to increase this to 10kW.

TANZANIA: Radio Tanzania continues to be heard on 15435kHz at 1900GMT when news in English is broadcast. Paul Edwards of Wellington, NZ, reports a verification in the "NZ DX Times" of Tanzania on 5050kHz. The verification was received in four months and was in the form of a card giving complete verification details.

SIGNALS FROM URUGUAY

Broadcasts from Sodre on 15273kHz have been noted by Bryan Clark of Wellington to close down abruptly at 0300GMT. The transmission has been in Spanish, with popular music. According to "Sweden Calling DXers" an international service now operates from Uruguay 2200-0100GMT on 11855kHz and 0100-0400GMT on 9515kHz. The broadcasts are in Spanish and English.

SIGNALS FROM MADAGASCAR

The Radio Nederland relay station at Talata, Madagascar, has been heard on several frequencies following the reduced transmission schedule from 80 to 50 minutes.

Broadcasts on 11730kHz have been noted at 2030GMT with a transmission for Indonesia, while at 0800 GMT an Indonesian program is carried on 21480kHz. A new frequency, 15385kHz, is used for English at 1830-1920GMT, but this transmission suffers interference from Rome radio, which is using the same frequency for a broadcast in Italian.

Another frequency, 15220kHz, has been noted at 2030GMT with a transmission to Africa. A broadcast in Dutch 1030-1120GMT is carried on 15165 and 17860kHz. Reports on these transmissions should be sent to the

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT; add nine hours for West Aust. summer time, 11 hours for East Aust. summer time and 13 hours for NZ daylight time.

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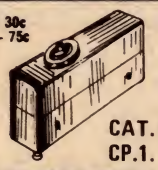
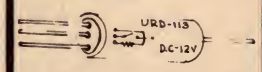
P&P 30c
10 — 75c



CAT. No: CP.1.

SUB-MIN. MICRO-SWITCH. Single pole change-over. 250V 5A. Size: *8mm x 9mm x 7mm. U.S.A. manufacture. **5 for $4.50.**

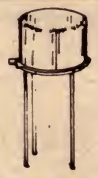
P&P 40c 10 — 75c



CAT. No: CP.2.

REED RELAY, Min. type. 12VDC on/off switch. Size of body — 20mm Dia: 7mm Overall Length — 45mm. **3 for $2.95.**

P&P 5 — 40c



CAT. No: CP.3.

BYF50 Gen. Purpose NPN Silicon transistor in TO-39 case. Vcb 80V 1 amp. **5 for $2.95.**

P&P 5 — 40c

CAT. No: CP.4.

BD135 NPN silicon Power transistor in TO-126 Flatpak. 8W. **5 for $3.00.**

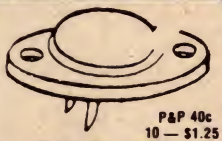
P&P 10 for 40c

CAT. No: CP.5.

BC209C Low noise high gain transistor in plastic TO-18 case. Silicon NPN. Vcb 30 100mA. **10 for $2.50**

CAT. No: CP.6. 10 — 75c

R.F. TRANSISTORS. Type 2N5944. Good to 470 megs at 2W output. Perfect as drivers for that FM LINEAR. **5 for $7.50.** with data

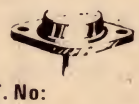


P&P 40c
10 — $1.25

CAT. No: CP.7.

2SB337 PNP germanium PNP Power transistor in TO-3 case. Sim. to OC28. Vcb 40 12W 7amp. **5 for $4.95.**

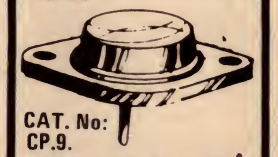
P&P 30c ea. 10 $1.00



CAT. No: CP.8.

2N3054 Silicon NPN Audio O/P transistor in TO-66 case. Vcb 90 4amp. **5 for $2.00.**

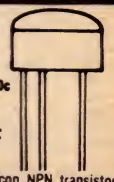
P&P 30c



CAT. No: CP.9.

2SB367 Germanium PNP Power transistor in TO-66 case. Vcb 25 1amp 4W. **5 for $3.50.**

P&P 10 for 40c



CAT. No: CP.10.

2N3643 Silicon NPN transistor in TO-105 plastic case. G.P. Amp. and switch. Vcb 60 500mA. Sim. to BC337. **10 for $2.95.**

CAT. No: CP.11. P&P 75c

RELAYS Miniature P.C. mounting type. Made by F.I.R.E. with 8amp contacts, single pole change/over. In the following values: 750Ω, 2.1K and 7K. Look at this for value . . . **the 3 for only $6.** All new and unused.

P&P 75c

CAT. No: CP.12.

RELAY Miniature P.C. mounting type. 12VDC double pole change-over with 5amp contacts. REAL VALUE HERE . . . **3 for $7.00.**

P&P 10 for 40c

CAT. No: CP.13.

COS/MOS Operational Amplifier with MOS/FET output. In 8 lead TO-5 case. **Only $1.95 each or 5 for $9.00 TYPE CA3130.**

P&P 10 — 40c

CAT. No: CP.14.

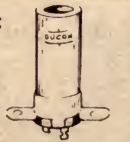
CMOS Wide-band Amplifier-Discriminators . . . Type CA3013. In 8 lead TO-5 case. GRAB 'EM WHILE YOU CAN . . . **ONLY LIMITED STOCKS at the silly price of 5 for $4.75.**

P&P 10 — 30c

CAT. No: CP.15.

BC177 S.S. Amp. transistors in TO-18 metal can. Can say no more about this popular and well tried PNP Silicon semi-conductor. **OUR PRICE ONLY 10 for $1.50.**

CAT. No: CP.16.



P&P 5 — $1.00

ELECTROLYTIC CAPACITOR. Can type with mounting bracket. Made by DUCON 100mFd 160VW **Tremendous and unrepeatable value at only 5 for $1.00.**

P&P Single 30c
10 — 90c

CAT. No: 17.

ELECTROLYTIC CAPACITOR: Top brand by WIMA (Germany) 10,000mfd 6VW Axial leads. **ONLY AT S.E. at 40c each or 10 for $3.50.**

P&P 10 — 30c
50 — 60c

CAT. No: CP.18.

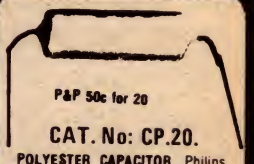
RECTIFIER DIODES. Unmarked S.T.C. brand, but guaranteed. Wire ended type. 100V 3amp. **10 for 75c**

P&P 75c

CAT. No: CP.19.

DISC CERAMICS. High voltage type with axial leads. 0.01mfd 12KV. Tremendous value of this hard-to-get Cap. Only limited quantities available. **LOOK AT THIS 18c each or 10 for $1.50.**

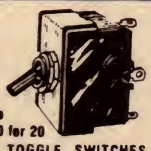
P&P 50c for 20



CAT. No: CP.20.

POLYESTER CAPACITOR. Philips tubular foil type 315 0.01mfd 160VDC. Axial leads. WOW! Look at our price. **20 for 75c.** Never again like this.

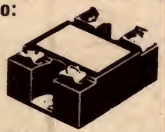
CAT. No: CP.21.



30c single
P&P $1.50 for 20

ARROW TOGGLE SWITCHES. Single pole double throw with moulded switch lever. Rated 250VDC at 3amp. HOW'S THIS FOR VALUE . . . **25c each or a carton of 20 for just $4.00.**

CAT. No: CP.22.



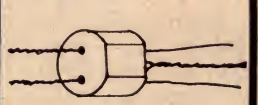
SOLID STATE RELAYS . . . They'll carry 10 amps and 250V switch and need 3 to 32 volts to operate efficiently. A third of the normal price. **ONLY AT S.E. for a paltry $5.50 each.**

P&P 40c for 10

CAT. No: CP.23.

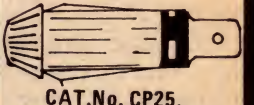
FERRITE BEADS. 6 holes. Size 10mm x 7mm dia. Ready wired. **45c anywhere else but at SHERIDAN'S only 12c each or 10 for $1.00.**

P&P 10 — 40c



CAT. No: CP.24.

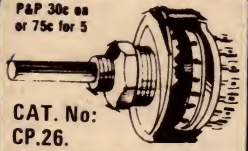
FERRITE BEADS . . . Size 5mm x 6mm dia. 2 holes. Ready wired. Another great BUY from us. **Only 10c each or 10 for 90c.**



CAT.No. CP25.

NEON LAMPS, Clear. For 240VAC. Suitable for Utilux clip-on connectors. Length (overall) 38mm x 13mm dia. **Normally about 60c each. From us only 30c each or 10 for $2.50.**

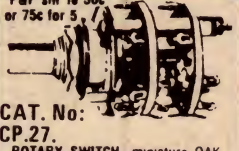
P&P 30c ea
or 75c for 5



CAT. No: CP.26.

ROTARY SWITCH, OAK type. 2 pole 4 position, single wafer. Shaft size 20mm x ¼". **IMPOSSIBLE TO BEAT PRICE of 45c each or 5 for $2.00.**

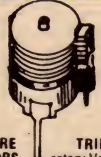
P&P sin le 30c
or 75c for 5



CAT. No: CP.27.

ROTARY SWITCH, miniature OAK type. 2 section 8 pole 2 position. Nylon wafers. Shaft size 10mm x ¼". HOW'S THIS FOR VALUE? **90c each or 5 for $4.00.**

P&P
10 — 40c



CAT. No: CP.28.

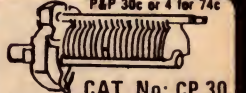
MINIATURE TRIMMING CAPACITORS . . . rotary Vanetype. 2 values available. 12 — 75pf and 9 — 60pf. Only 10mm dia x 15mm deep (overall) **5 of each for only $2.25.** REAL VALUE HERE

P&P
6 for 30c

CP.29.

MINIATURE TRIMPOTS. Made by PIHER. P.C.B. Mounting. 10mm dia x 15mm long. 2 each of the following values: 50Ω — 200Ω — 100K. **The 6 for 75c.**

P&P 30c or 4 for 74c

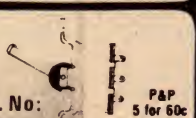


CAT. No: CP.30.

AIR-SPACED VARIABLE CAPACITOR. Top quality by JACKSON BROS (UK). 150pf. Silver plated Vanes & Ceramic end plates. TOP QUALITY. LIMITED QUANTITIES ONLY . . . Worth $5 each. **From us only $1.25 each or 4 for $4.75.**

CP.31.

PRECISION MINIATURE TRIMPOTS . . . 20 TURN Wire wound. Made by RELIANCE. In the following values: 20Ω — 100Ω and 1K. **The 3 for $2.50. A REAL GOOD-BUY. . . or 10 assld. for $7.50.**



CAT. No: CP.32. P&P 5 for 60c

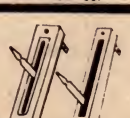
SWITCHES . . . 2 hole fixing with satin finished lever, 2 pole change/over. 35mm hole centres. Cannot be bought under 65c each. **S.E. price 35c or 5 for $1.50.**

CP.33.

P&P single 30c or 75c for 5

ROTARY SWITCH . . . Sub-miniature sealed with adjustable stops. 10 pos. 2 pole. Overall length 33mm. Dia. 12mm. Shaft 10mm x 3mm. **EXPLOSIVE VALUE AT ONLY $1.95 each or 5 for $8.50.**

CAT. No: CP.34.



SLIDER POTENTIOMETER . . . 3 singles in 1K — 10K and 500K and 2 duals in 5K and 50K. Total normal retail approx. $4.75 **but from us only $1.00.**

P&P 60c

CAT. No. CP.35.

WIRE WOUND TRIMMING POTS . . . Made by EGEN (G.B.) 4 watts. Precision standards complete with integral knob. In the following values: 100Ω — 220Ω — 470Ω and 1K. **The 4 for $1.75.** YOU CAN DO NO BETTER

SHORTWAVE SCENE

Frequency Office, Radio Nederland, PO Box 222, Hilversum, Holland.

SUNSPOTS INCREASE

The increase in the sunspot count is now being reflected in better reception on the higher frequencies as we leave the low point in the 11 year cycle and move towards the maximum. A recent check shows that last October the count reached 41.

According to the World Radio Handbook newsletter the minimum was reached in May 1976.

SPAIN'S NEW FREQUENCIES

Spanish National Radio at Madrid has made some frequency changes for the present summer transmission period. The broadcast in Spanish to Australia and the Philippines from 0800 to 1100GMT is at present on 9520, 11740 and 17750kHz. The use of 9520kHz has been observed with a fair signal in the early part of the transmission, but 11740kHz suffers severe interference from Radio Australia up to 0900GMT.

The English broadcast to Europe from Madrid 2030-2130GMT and 2130-2230GMT is now broadcast on three frequencies: 6100, 7155 and 9505kHz. This broadcast in English is of one hour duration and is repeated at 2130GMT.

GERMAN DX SESSION

Deutshe Welle at Cologne has been heard with a monthly DX Session in English and German for several months. At present, the best reception is during the transmission to the Pacific at 0740GMT. The frequencies that carry the service include 9690, 9735, 11795, 17845 and 21560kHz. The broadcast is on the second Saturday of each month and the short DX items are alternated between the two language announcements. Information on sunspot predictions is a regular feature of the program.

1978 CONVENTIONS

Three DX organisations in Australia and New Zealand will be holding conventions over the Easter weekend March 24-27. The New Zealand Radio DX League Convention is to be held at Tiwai near Invercargill and will be hosted by the Southland Branch. Last year the convention was at Christchurch and members attended from Australia and Hawaii and throughout New Zealand. Convention details are available from the New Zealand Radio DX League, PO Box 1313, Invercargill.

The Easter weekend is also to be the date of the annual meeting of the New Zealand DX Radio Association. This will be held at Warrington near the seaside locations of Long Beach and Doctors Point, which were the major listening areas for North American medium-wave stations some 30 years ago and are located just north of Dunedin. Details on this meeting are available from 78 District Road, Green Island, Dunedin.

The Australian convention is being organised by the Australian Radio DX Club and will be held at Canberra. Information on this convention is available from ARDXC, PO Box 227, Box Hill, Victoria, Australia, 3128.

LISTENING BRIEFS

EUROPE

BULGARIA: Radio Sofia broadcasts in English for listeners in Europe 1930-2000GMT on 6070 and 7270kHz and 2130-2200GMT on 5915 and 7115kHz. They also have a transmission in Spanish at 2300GMT on 15435kHz.

HUNGARY: Radio Budapest is being well received in its transmission to Australia and New Zealand 1030-1100GMT. The frequencies in use — 15160, 17715 and 21525kHz — have all been heard by listeners in New Zealand, according to the "New Zealand DX Times". According to the latest schedule from Radio Budapest, the station is also using 6040, 7155, 9585 and 11910kHz. The transmission in English to North America has been noted on 11920kHz instead of 11910kHz and our reception has been for the period 0300-0330GMT.

AUSTRIA: According to the "Australian Radio DX News", the Austrian Radio is broadcasting to Australia and Asia from Vienna 0400-0600 on 17840; 0600-0900 on 17815; 0600-0900 on 15105 and 0900-1300GMT on 17710kHz. The English periods are 0430-0500, 0830-0900 and 1230-1300GMT.

FINLAND: Helsinki, in its new transmission to Australia and New Zealand on Sundays 0800-0930GMT, made a frequency change after its initial broadcast due to co-channel interference from Radio Moscow on 21490kHz. Finland is now broadcasting on 21495kHz. This frequency has been providing very good reception for the 90 minute English program, which includes a talk on short-wave listening at 0825GMT.

AFRICA

EGYPT: Radio Cairo, in its service to South America 2330-0045GMT in Portuguese, has returned to 11715kHz and is also using the new frequency of 9620kHz.

NIGERIA: The latest schedule of the External Service from Lagos, according to the "World Radio and Television Newsletter", is 0555-0835 on 7275 and 15120; 1530-1700 on 7275 and 11770; and 1800-1930GMT on 7275, 11770 and 15120kHz for the English transmissions. Other broadcasts are in French, Arabic and Hausa.

ASIA

ISRAEL: Jerusalem is the only broadcaster using the 11 metre band at present and Robert Jones of Sydney, reporting in ADXN, gives the time of reception as 1400GMT. Israel is broadcasting on 25605kHz and has been heard with a Yiddish program. The increasing sunspot count should result in more activity on this band during our summer season later this year.

INDONESIA: Robert Yeo of Melbourne, reporting in ADXN, notes that Jayapura on 4980kHz has station identification at 0958GMT when the frequency was carrying the same program as 6070kHz. Another Radio Republik Indonesia station at Biak, on 7210kHz, was heard with station identification at 1342GMT following a news service.

AMERICAS

ECUADOR: HCJB in Quito has been heard with its transmission to Europe on the new frequency of 15405kHz at 2000GMT. At this time, the broadcast is in Spanish, while at 2100GMT the language carried is Swedish. This frequency replaces 15435kHz.

PARAGUAY: Radio Nacional in Paraguay has been heard in Spanish on 9735kHz at 0925GMT. John Mainland of Wellington, reporting in the "Australian DX News", states that there is severe interference from a Deutsche Welle transmitter on the same frequency.

GUATEMALA: Radio Miramundo, Zacapa, has been heard in North America by Ralph Perry, reporting in "Tropical DX", on 6158kHz at 1100GMT. The station opened with an anthem, followed by frequent announcements and marimba musical items.

NEW BOOKS

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Radio Amateur Callbook 1978
- US Listings $19.50
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Radio Communication Handbook, RSGB, 5th ed.
- Vol. 1 ..... $21.95
- Vol. 2 ..... $18.90

World Radio TV Handbook 1978 edition — due soon, order now. Approx. $12.95

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How To Select & Install CB Antennas — Hayden Books $6.95

99 Ways To Improve Your CB Radio — Buckwalter $5.60

Pictorial Guide To CB Radio Installation & Repair — F. Belt $8.50

Practical CB Radio Servicing — Freeland $9.75

The Truth About CB Antennas — Orr & Cowan $8.50

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Advanced Applications for Pocket Calculators — Gilbert $8.50

Amateur Radio Techniques — Hawker, RSGB $7.40

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Antenna Handbook, ARRL $8.80

Australian Radio Amateur Callbook 1977 ..... 2.85

Basic Electronics, Grob, new 4th edition 20.05

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Books & Literature

Microcomputers . . .

MICROCOMPUTER PRIMER, by Mitchell Waite and Michael Pardee. Published by Howard Sams, Indianapolis, 1977. Soft covers, 138 x 215mm, 224pp, many illustrations. Price in Australia $9.75.

HOW TO BUY & USE MINICOMPUTERS & MICROCOMPUTERS, by William Barden, Jr. Howard Sams, Indianapolis, 1977. Soft covers, 215 x 280mm, 240pp, many illustrations. Price in Australia $13.50.

Two more books for the microcomputer enthusiast and professional, and both from Howard Sams. As its title suggests the first is intended as a basic introduction to the key concepts, while the second is rather more specific and practical in orientation. All three of the authors are industry professionals, who also happen to be enthusiasts.

The Waite-Pardee book consists of four chapters, titled 1— Perspectives; 2— Basic Computer Concepts; 3— Hardware; and 4— Programming. The first chapter is a brief introduction to microcomputers and their historical development, while the second explains computer anatomy and basic operation of systems. The third chapter deals with actual microprocessor chips and their operation, together with memory and interfacing chips, while the fourth chapter deals with both basic programming concepts and specific instruction sets. The book ends with two appendices, one summarising number systems and the other describing the construction and operation of RAM, ROM and PROM memory devices.

In general, the book seems reasonably informative and should be of value to the person with a background in basic digital concepts who is looking for an introduction to microcomputers. However many of the concepts are dealt with very briefly, so that you may need to read other books as well — particularly if you have no background at all in basic computer operation.

Much the same comment applies to the Barden book, although less so. Here the author does spend quite a bit of time dealing with basic concepts, even though the book is nominally more concerned with specific systems and their use.

There are nine chapters in this case, titled as follows. 1— Introduction; 2— Minicomputer Basics; 3— Minicomputer Hardware; 4— Minicomputer Software; 5— Minicomputer Peripheral Devices; 6— How to Select and Buy a Minicomputer; 7— Programming Your System; 8— Microcomputer Profiles; 9— Minicomputer Profiles. The book ends with no less than 10 data appendices.

If I had to choose between the two

books, I think I would have to choose the Barden book as the more helpful and satisfying. However it too should ideally be supplemented by further reading, for a sound understanding.

Both books were submitted for review by Dick Smith Electronics. The DSE catalog number for the Waite-Pardee book is B-1276, while that for the Barden book is B-1274. Both should be available from DSE stores and dealers shortly after you read this review. (J.R.)

AN INTRODUCTION TO MICROCOMPUTERS, Volume 2 — June 1977 revision, by Adam Osborne, Susanna Jacobson and Jerry Kane. Soft covers, 132 x 205mm, 38mm thick (pages not continuously numbered). Many diagrams. Price in Australia $19.50.

Adam Osborne's 2-volume book on microcomputers has now become well known and something of a classic. This is the new updated and revised version of volume 2, even fatter and more informative than before. A little more expensive, too, but most people who have read them agree that the Osborne books contain a wealth of useful information.

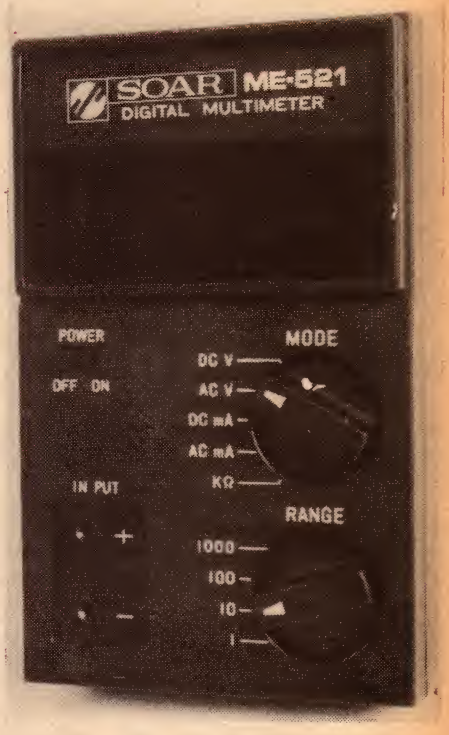
For objective, reliable information on the various microprocessor chip sets and their operation, this volume would be hard to beat.

The review copy came from Dick Smith Electronics, who advise that the catalog number is B2342. (J.R.)

New Products

SOAR ME-521 Digital Multimeter

The SOAR ME-521 Digital Multimeter has recently been made available on the Australian market. It is a low-cost three digit unit with automatic zeroing and polarity, and can measure DC and AC volts, DC and AC currents, and resistance. It will operate from internal dry cells or an external DC source.



The unit is mounted in a black plastic case, measuring 95 x 155 x 45mm. A four-digit LED display is provided at the top of the case (the fourth digit is used only for the - sign). The display character height is 8.5mm.

Power supply is by four AA cells, or an external 6V DC source. No provision has been made for the use of rechargeable batteries. A pair of red and black testleads are supplied, as well as an instruction manual.

Five operating modes and four ranges are provided, selected by two recessed rotary switches, which have a very positive "feel". The power switch is a miniature slide type, while input connections are made by means of banana jacks (these are well insulated, so use of the unit on high voltages is safe for the operator).

On the voltage ranges, the input impedance is 10M ohms, while the maximum input voltage is 1000V DC or 600V RMS AC. The four voltage ranges have full scale readings of 999mV, 9.99V, 99.9V and 999V, with resolutions of 1mV, 10mV, 100mV and 1V respectively. Overranging is indicated by a flashing display.

Specified accuracy on the DC ranges is $\pm$ 0.5% $\pm$ 1 digit, while for the AC ranges it is $\pm$ 1% $\pm$ 1 digit.

There are four current ranges for DC and four for AC, in each case with full scale readings of 999uA, 9.99mA, 99.9mA and 999mA and resolutions of 1uA, 10uA, 100uA and 1mA respectively. The maximum voltage drop is 200mV for the three lowest ranges, and 250mV for the highest range. Specified accuracy is $\pm$1% $\pm$1 digit.

On the ohms ranges, the unit is perhaps a little disappointing as the maximum resistance which can be measured is 999k ohms. The four ranges provided have resolutions of 1 ohm, 10 ohm, 100 ohm and 1000 ohms. The input circuit is protected to $\pm$ 500V DC or 350V AC (RMS).

Test current on the lowest ohms range is 1mA, falling to 1uA on the highest range. Accuracy is specified as $\pm$1% $\pm$ 1 digit.

A battery test facility is provided, so that the condition of the battery can be displayed. Suggested end life of the cells is 1.05V. Overload protection is provided by a fuse and a diode, and a spare fuse is provided in the battery compartment. We believe that this is a very handy feature, as it will allow the fuse to be replaced in the field.

Another interesting feature is that a calibration procedure is described in the manual, so that provided one has access to the appropriate standards, the unit can be recalibrated.

Summing up, we found the Soar ME-521 to be very simple to use, and one which would be quite suitable for both bench and field servicing. At the recommended price of $80.00 including tax, it is very good value for money. The unit is available from Radio Despatch Service, 869 George Street, Sydney 2000. (D.W.E.)

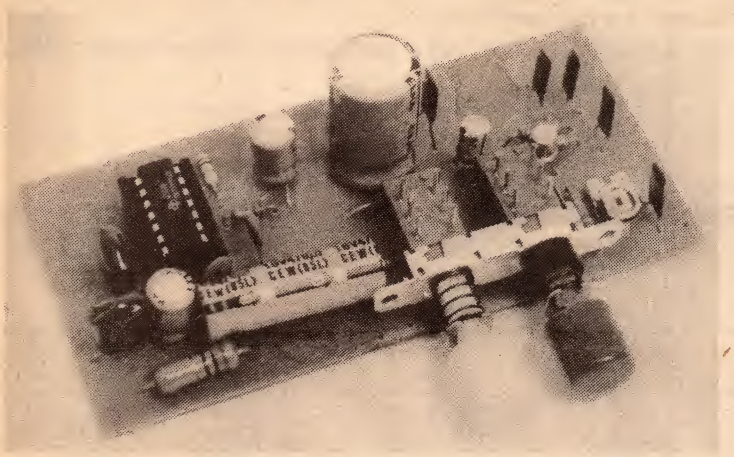
Multi-code radio control systems

The Multi-code digital radio control system is designed for remote operation of garage door openers and similar equipment. The system operates on a frequency of 40.68MHz, for minimal interference. It uses 10-bit digital encoding, with programming switches inside both transmitter and receiver to allow selection of the 1024 available codes for security.

Further information is available from the distributor, Raydoor Pty Ltd, 35 Tait Street, Five Dock, NSW 2046.

Intercom unit comes as a kit

For those interested in intercoms, a kit currently being marketed by Davred Electronics should provide a handy starting point for a complete system. The kit makes up into the basic amplifier, with switching, but leaves the choice of speakers, boxes, etc to the constructor.



The amplifier in the kit is based on the Texas Instruments IC SN76001, which provides the main amplifier and output stages, preceded by a BC109 as a preamplifier. It is rated to deliver 1.5W into an 8 ohm load.

The basis of the kit is a small printed board on which the amplifier is built, and which also accommodates the necessary switches. Two switches are used, both press-button types, one an on/off switch and the other the press-to-talk switch. They are mounted in a single housing and are interlocked so that operating the press-to-talk switch also operates the on/off switch and turns on the amplifier. The on/off switch is operated manually to turn off the amplifier at the finish of the conversation.

A three conductor cable, preferably shielded, is required between stations, and the direction in which the amplifier works is controlled from the master station only. A simple push button circuit from the slave station provides a calling system by switching the amplifier into an oscillating mode. The remote station can be monitored from the base station, making it suitable for use as a baby minder, invalid monitor etc.

The whole system operates from a 9V supply, typically a battery, but a power supply could be used if desired. There is a small drain, approximately 50uA, on the battery at all times and it is recommended that the battery be disconnected when the system is not required for long periods.

A sample kit was supplied to us by Davred and built up in our own workshop. Although the exercise was completed without any problems, and the unit worked immediately it was switched on, we found a number of points in the instruction sheets which we believe could confuse the beginner.

These were mainly concerned with orientation and lead identification of the transistor and the IC, due to the substitution of components which differed physically from those for which the instructions were prepared. We have taken this matter up with Davred, who have indicated that they intend to look into the problem.

The board supplied to us was a pre-production sample and, as can be seen in the photograph, was bare on the component side. Those to be marketed will be silk screened with a component layout pattern, to simplify construction.

On test the amplifier fell short of its power output specification. The closest we could get to the anticipated 1.5W was about 1W, but this difference is not really important; the power available should be quite adequate in most situations.

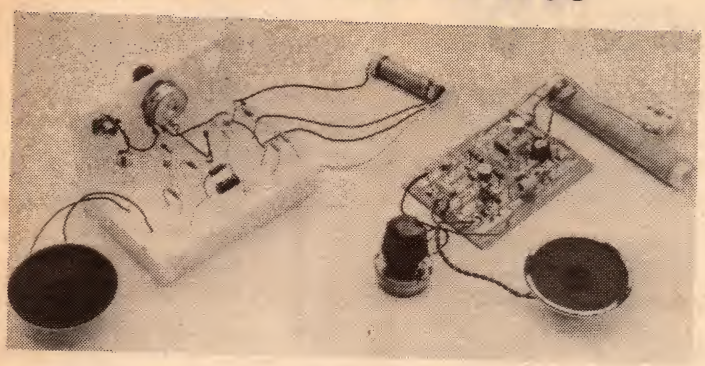
Tested as an intercom with a pair of 125mm speakers it proved quite adequate as regards both power output and sensitivity, although the gain would probably have to be set to maximum in most cases.

The calling tone from the remote station was, we thought, rather raucous. But, as the instructions indicate, this is quite easy to modify by changing the value of one capacitor.

For anyone wanting a simple domestic intercom this kit would provide a good starting point and, at the price quoted ($8.25), a very economical one. Even allowing for the additional cost of speakers, battery, cable etc, it could still be a modest outlay, particularly if the constructor could build his own speaker boxes.

Further enquiries should be made to Davred Electronics Pty Ltd, 105 King St, Newtown, NSW, 2042. (P.W.).

Breadboards and "Blob Boards"



DEC is the name given to a new circuit prototyping aid which comes in four different types. Component leads are simply pushed into the desired contact holes and are held firm by double leaf spring contacts of phosphor bronze.

The four different DEC types are: S-DEC, T-DEC, U-DEC 'A', and U-DEC 'B'. S-DEC is designed solely for discrete components; T-DEC allows 2 TO5 or 1 DIL IC station to be used; U-DEC 'A' allows 2 DIL or 4 TO5 stations to be used; and U-DEC 'B' is similar to U-DEC 'A', but features two 16 lead IC sockets as part of the board.

The "Blob Boards" are PC boards that have been etched and roller tinned to specific designs. They come in three different ranges: 'V' range, 'D' range, and 'IC' range.

The 'V' range is similar to matrix board, with a number of tinned copper strips running the full length of the board. The 'D' range is mainly for discrete components (but can also be used with ICs), while the 'IC' range is the one to use when working mainly with ICs.

Further information from Adrian Michell's Television Replacements, rear 139 Union Road, Surrey Hills, 3127.

Letters to the editor

November Issue

It isn't very often that I feel impelled to write to the editor of a magazine or newspaper, but this is one such occasion. First let me sugar the pill by saying that you consistently produce an informative, interesting and entertaining magazine of high quality.

Now for the criticisms. Firstly, the method of binding used for the November 1977 issue. I am not enamoured with this, for a number of reasons. In my experience this type of binding is not as long lasting as stapling, while it is also not as amenable to storage in wire files, the usual method for "temporary binding".

More importantly, it does not seem possible to remove the Tandy catalog without wrecking the whole magazine. I like to keep my back numbers at home for reference and some catalogs in my desk drawer at work. This seems no longer possible.

My second point relates to the article on page 5 of November, concerning metric conversion. Your own magazine has been reasonably to the fore in promoting metric conversion in the past, but you are still not polished, and do not conform fully to the requirements of AS 1000. In particular the groupings of figures, the use of a zero before a decimal marker and the provision of a space between number and symbol. I think you might be surprised at the improvement in legibility that results from use of the recommended standards. You might also use your influence with advertisers; some advertisements abound with horrible examples of pseudo-metric conversion.

May I conclude with another compliment: thank you for not going overboard with CB radio.

D. J. Power,
Glen Iris, Victoria.

COMMENT: Your letter was one of a number registering a complaint about the November issue. However the binding used was unavoidable if we were to provide readers with the bonus catalog — it was so large that alternative methods were either impractical or prohibitively expensive. Your comments on metric standards are noted, and we will see what can be done to improve our "polish".

Dice article

I would like to compliment you on your article describing the DICE Television Standards Convertor, which appeared in the October 1977 issue of Electronics Australia.

The article makes very interesting reading, and I will make use of it as a reference to quote to clients asking for information on the operation of DICE.

As well as being an interesting article to your readers, I am sure ATN-7 will benefit from the publicity.

We have just purchased two Quantel Frame Store Synchronizers, the first to be delivered to Australia, which are also capable of storing one television frame. They use CMOS RAM as the storage element, and take only 8¾ inches of rack space. They enable us to treat remote feeds as local or synchronous sources, without the necessity to genlock, with its subsequent problems.

R. Dalliston, Chief Engineer,
Channel 7, Sydney,
Amalgamated Television
Services Pty Ltd.

CASSETTE DECK
from p48

the negative supply rail (as supplied) otherwise hum will result.

The three 6.5 jack sockets must be mounted on an insulating panel or otherwise mounted so that they are electronically isolated from each other. Use shielded microphone cable (having two conductors within a common shield) to wire the microphone sockets. This is most important. Any other cable is likely to produce hum in the recording mode.

Make the connections to the mechanism PCB very carefully and be very careful to avoid overheating the copper track, otherwise it will lift.

As we said at the start, this project presents some challenges in construction. But if you are careful and patient, the end result is rewarding.

NOTES & ERRATA

10GHz BURGLAR ALARM (July 1977, File No. 3/MS/70): The 12V relay being supplied in kitsets for this project will not work at 6V. Fortunately, the PCB is easily modified to supply 12V to the relay. Simply cut the track running under the 10k resistor in the collector network of T1. Now join cut section of track to the relay circuit to the 12V side of the 10k resistor.

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SORRY NO C O D

INFORMATION CENTRE

POLARITY CONFUSION: Referring to your "Modular Digital Clock", December 1976 (File No. 7/CL/25), I observe that the alarm in the optional circuitry has its positive terminal connected to the "OV" line and its negative to the collector of the BC548, which is the positive connection. Why is this so? This may be of interest to other readers. (G.T., Turramurra, NSW.)

● There is really nothing strange about this connection, GT. The line marked "OV" is so designated purely for reference purposes. Note that the emitter of the BC548 connects to the -6.5V line; the most negative point in the system. Or try it this way. While confining our attention to this part of the circuit, change the "OV" label to +6.5V and the "-6.5V" label to OV. It will probably make sense now, but the important thing is that we have changed nothing as far as the actual device is concerned — only the labels. And both sets of labels mean the same thing.

200MHz DFM: A request for information from R.D., of Corio, Victoria in the November 1977 issue of "Electronics Australia" prompted me to also register with you the fact that I have had an abnormally high number of segment failures in my 200MHz DFM. The total now stands at six in four months. I have increased the drive resistors from 27 ohms to 47 ohms but this has not prevented further failures. (G.T., Bracken Ridge, Qld.)

● A representative of Dick Smith Electronics has recently admitted that they received a large batch of faulty LEDs. Apparently it took some time before they realised the problem. If you were supplied by Dick Smith Electronics you should ask for a credit on the defective LEDs.

PLAYMASTER TWIN 25: As an interested young experimenter, I have been stydying your articles on the Twin 25 and Twin 40 amplifiers. The only differences between the two board layouts are two tantalum capacitors of 0.22uF and transistors T9 and T10 in both channels. The major change is in the power transformer, which has a 5V difference in output. Would it be safely possible to replace the Twin 25 components in question with their complements in the Twin 40?

With the changeover kit supplied by Dick Smith Electronics, the expensive C-core transformer would seem to be unnecessary, unless the increased power output increased the hum to an unbearable level. Could extra smoothing be introduced into the circuit to counteract this? I am looking forward to buying a Twin 25 and with your help, possibly converting it to a Twin 40. (I.R., Mayfield, NSW).

● As we noted in the first article on the Playmaster Twin 40 in December 1976, all the changes therein may be implemented in the Playmaster Twin 25. They are recommended, in fact.

The main argument in favour of the power transformer, which was also mentioned in the article just referred to, is not the increased power capability but its lower flux leakage. The amplifier is physically quieter because the chassis and lid are less likely to vibrate. And there is less hum induced into magnetic cartridges and cassette decks. The transformer is worth the money.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past two years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Available only until our stocks are exhausted. Within three months of publication, face value. Four months and older, if available, $2. Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

Marketplace

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REPUTABLE ELECTRONIC PARTS outlet in Hong Kong — If you are seeking reliable source of quality supply of ICs transistors, caps, resistors, digital displays, buzzers, wide range of AM/FM radio parts, etc. Write to us now for catalogue list: ProElectro Enterprises, PO Box 10240, Hong Kong.

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WANTED

LATE TYPE CROs for parts and circuit diagrams. Write only T. Sorensen, 31 Yacht St, Clontarf, Qld 4019. Will pay for circuit diagrams.

TENDERS & QUOTES

QUOTATIONS are invited for the supply to the Biloela Fire Brigade of two (2) only "walkie talkie" radio units, to operate on the frequency of 27.33MHz with a power of up to 5 watts. The equipment should be fully fitted for licensing with the relevant authority. Quotations should also include details of the soare parts and service available, and also the availability of rechargeable batteries for the units offered and an appropriate battery charger.

Any further inquiries should be directed to the undersigned, with whom quotations close on February 10, 1977, at noon. Please enclose quotations in a sealed envelope endorsed "Tender for Radios".

The lowest or any quotation not necessarily accepted. A. J. Parker, Secretary, Biloela Fire Brigade Board, PO Box 232, Biloela 4715.

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